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VOLUME SIX

A HAND-BOOK
OF
GENERAL AND OPERATIVE
GYNECOLOGY

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BY DR. A. HEGAR AND DR. R. KALTENBACH

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THE UNIVERSITY OF GIESSEN.

In Two Volumes.

VOLUME I.—GYNECOLOGICAL EXAMINATIONS, MINOR
THERAPEUTIC MANIPULATIONS AND ELEMENTARY
OPERATIONS, OPERATIONS ON THE OVARIES.

WITH ONE HUNDRED AND TWENTY-NINE FINE WOOD ENGRAVINGS.

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A HANDBOOK OF

General and Operative Gynecology.

INTRODUCTION. GENERAL CONSIDERATIONS.

THE subject of our investigations and therapeutical measures is woman, with her physical and psychical peculiarities. The height of her body is less than in man, the bones are thinner. The muscular tissue is less prominent compared with the abundant and often loose cellulo-fatty tissue. This often very loose tissue is found in larger amounts, particularly in the abdominal walls, around the genitals, hip and thighs, and in the latter parts it is apt to be associated with dilatation of the veins.

The sexual organs are more voluminous than in the male, and the vessels and nerves supplying them are larger. This corresponds to the more considerable physiological function of these organs, which is especially manifest on the occurrence of pregnancy.

The female sexual organs occupy, in general, a more concealed position than in man, and hence their examination requires a special, often very difficult technique, which may become even more complicated in operations. The extirpation of many tumors can only be done by means of laparotomy.

Large portions of the sexual organs are in immediate contact with, or in the neighborhood of, the peritoneum, and the loose sub-serous tissue which is rich in vessels, venous plexuses and lymphatics. Hence, the tendency to the reception of inflammation-producing and fever-producing substances, the readiness with which inflammations spread, and the tendency to thromboses.

Large portions are also closely related to the urethra, bladder and rectum. Swellings and inflammatory conditions, for example, after operations, readily extend, therefore, to the bladder, produce cystitis, or, at first, ischuria, and, as catheterization becomes necessary, cystitis. Diphtheria may extend from the vagina and external genitals to the bladder or may be conveyed by the catheter. Catarrhal and diphtheritic processes not infrequently spread from the bladder to the renal pelvis.

The varying degree of fullness of the bladder and intestines must be taken into account in determining anomalies in the shape and position of the uterus. As a general thing, this has less influence on the healing of operation wounds than might be expected. Furthermore, the spontaneous evacuation of the bladder and soiling with urine produce very little bad effect, especially in plastic operations, but evacuations from the bowels may prove injurious in perineal plastic operations.

The field of examination and operation (vagina and uterus) is very movable. This becomes noticeable during respiration and straining, and is apt to disturb the inexperienced. The great flaccidity, yielding character and presence of folds in the vagina often impede the exposure of diseased parts and interfere with the tension requisite in making incisions.

To these conditions dependent on the locality of our mechanical measures is added the peculiarity of the nervous system, its increased irritability, which is still more exaggerated by pathological processes in the genitalia. Symptoms of shock may therefore set in, especially when too much is expected of the patients with regard to the endurance of pain, etc. Much more often overlooked by the physician (and produced by himself) is the injury resulting from too often repeated, though lesser irritations of the sexual organs, as, for example, in manual or instrumental examinations, cauterization, scarification, etc. Sensitive patients may thus be brought into a condition of the greatest nervous depression, which may even approach psychical disturbance.

The female subject also varies extremely according to age and the condition of the sexual function, a feature which must be taken into consideration. Children are rarely the object of gynecological examination. Even when anomalies are present in them, they are generally tolerated without disturbance, on account of the relative repose of the sexual functions. Catarrhal inflammations and errors of development come most frequently under the observation of the physician. In the virgin only one sexual function of the highest importance, *viz.*, menstruation, is developed, and this is generally associated with the ovulation which leads to the development of the mature ovum. With this phase in female life certain anomalies first produce their effects. The new function and the comparatively rapid enlargement of the corresponding organs permit the ready action of accidental injurious factors. At this time we often note the beginning of diseases which accompany the individual through life. There are two points of special value with regard to examination and local treatment in such individuals. Certain ethical considerations make it our duty to restrict or modify our examination (exploration through the rectum, anæsthetization of the patient, etc.); in like manner, direct local measures in treatment should be avoided or restricted if possible.

According to former notions the menstrual period contra-indicated not alone every operative procedure, but also all thorough examinations. Exploration was recommended only when intra-uterine growths were suspected, because the finger could then pass the loosened cervix more readily, and because tumors are occasionally pushed downwards at this time. To-day better means are known of rendering the parts accessible. Numerous experiences have shown that exploratory and even therapeutic measures during the menstrual period do not produce the dangers which were formerly anticipated. It is even said that favorable effects have resulted from the increased blood supply, especially in plastic operations. As a general thing, however, the old rule still holds good that all manipulations of moment should be suspended shortly before and during the menses, except in urgent cases.

After marriage two other functions of the sexual organs are manifested, *viz.*, coitus and pregnancy. The former not infrequently causes disease, either because it is performed excessively or at improper times (menses). On account of the greater irritation and hyperæmia produced by coitus other injurious factors will act more readily. Finally, infection is often conveyed in coitus (gonorrhœa, syphilis).

Pregnancy, parturition and childbed play a prominent part in the development of diseases of women. It was formerly supposed that more important operations are especially dangerous at this period and must be avoided. But this view has undergone change. Even very serious operations, such as ovariotomy, have been performed during pregnancy, and the neck of the uterus has been amputated during delivery or in the puerperal state. But such surgical operations should not be performed, as a general thing, during pregnancy, if they can be delayed or are not indicated by the condition. Thus, ovariotomy will make room for the growing uterus. Interruption of pregnancy, and not infrequently peritonitis, septicæmia, exhaustion and fatal hemorrhages have been observed not alone in surgical operations on the genitals, but also on remote parts. The special frequency of septicæmia as the cause of death shows that there must be other causes of the fatal termination than the operation and the period at which it was performed. But it cannot be denied that the condition of the blood in pregnancy, and especially the structure of the vessels, particularly near the genitalia, favors the absorption of injurious substances and facilitates their further transportation. The interruption of pregnancy also entails certain dangers.

As far as regards the puerperal condition, it is undoubtedly advisable to delay considerable mechanical interference. The impairment of the general condition, the consideration to be paid to the dilated veins, the greater tendency to thrombosis, the increased predisposition to the reception of septic matters, the need of undisturbed progress of the process of involution, favor such delay. All operations may be performed seven or eight weeks after delivery, unless it compels the removal of the child from the breast. Some advantages are claimed for certain operations if performed at a period not too remote from delivery. The sexual organs are then more movable, and the ligaments more flaccid, factors which are favorable in ovariotomies and castrations. The hyperæmia is advantageous in plastic operations, since it favors union by first intention.

The period after the menopause furnishes a large contingent of gynecological cases, among which new growths and prolapses play a prominent part. Advanced age may impose certain restrictions with regard to operative and other violent mechanical measures.

CHAPTER I.

GYNECOLOGICAL EXAMINATIONS.

COURSE OF THE EXAMINATION.—ANAMNESIS.

THE immediate object of every examination of a patient consists in the making of a diagnosis. The gynecologist concerns himself with a limited number of organs and parts of the body, and, therefore, with the diagnosis of a sexual disease. Nothing would be more erroneous, however, than to confine ourselves to this and to forget that we are dealing, not alone with a diseased part of the body, but with a sick individual. Other specialties will admit, perhaps, of a restriction to a one-sided standpoint, but in our department this is entirely misplaced. Anomalies in the sexual organs are often secondary—accompanying symptoms of other local or more general diseases. Even when they have developed primarily they have not infrequently given rise to such marked disturbances of other parts, that these form the object of medical skill. The overlooking or insufficient consideration of such disturbances is apt to be severely punished, often for the reason that the patients are tasked beyond their strength by mechanical manipulations. By no means the worst therapeutic results are sometimes obtained when we discontinue treatment, at least all local treatment, of even marked sexual diseases, and devote our attention to the improvement of the general condition and to the relief of individual annoying symptoms. The busy gynecologist sees many women who are supposed to be suffering from uterine disease, but in whom this does not exist, or at least is of a trifling character. If severe symptoms are present in such cases, and do not correspond to the objective appearances, we must search further and not overlook some perhaps serious affection in other parts of the body. On the other hand a gross error may be made if considerable disease of the sexual organs is really present, and at the same time the symptom-complex is similar to that which is generally found in such diseases. We are then easily induced to attribute everything to the sexual disease, and not infrequently overlook an affection of other organs.

The course of examination is the same as in all other patients. The previous history is first ascertained, then the present symptoms, and, finally, the objective examination is made.

The latter constitutes our main object, but we also think it advisable to consider the former.

With regard to anamnesis, hereditary conditions do not play a great part in the majority of sexual diseases. But their recognition may be valuable with regard to nervous disturbances, tumors, scrofula, hæmophilia, etc. Pelvic inflammations, scrofula and leucorrhœa must be especially considered among the pathological processes in childhood. It is necessary to be informed concerning the first appearance, course and character of the menses, and the further course of development of puberty. Special attention should be paid to chlorosis, or severe intercurrent diseases at this period and to their influence on the menses.

Then follows, in married women, the influence of marriage on the sexual functions, especially on menstruation. In women who have had children we should inquire about the course of pregnancy, parturition and childbed, diseases at such periods, and the influence of previous births upon the menses. In patients at an advanced age the course of the menopause should be noted. The previous history may be made very brief, and yet contain the most essential points.

A precise knowledge of the present symptoms is specially important. We are thus compelled, in the subsequent objective examination, to note accurately the connection between its results and the symptoms; nor will we be so apt to mistake the uterus as the cause of certain symptoms of which it is entirely innocent. Thus the patient not infrequently consults the physician concerning some annoying symptom, for example, severe pain in the back or frequent micturition, and for which she requires relief. The physician must then determine the mode of development of the single symptom in order to relieve it by a radical or, perhaps, merely symptomatic treatment.

The symptoms very often refer to the menses, which may be changed as regards the intervals, duration or character, are often accompanied by pain, and may also differ from the normal process by their injurious effect on the general condition. Complaint may be made of bloody or other transudations in the intervals.

Painful sensations in the sexual organs, or those which have their starting-point in the latter, not infrequently develop in the middle of the interval. Other symptoms, such as leucorrhœa, discharge of blood or consensual phenomena, may also appear. The process has been termed "intermediate pain," because the pain was regarded as the most striking symptom.

The neighboring organs, the bladder and rectum, are implicated mechanically or by extension of the morbid process; hence the numerous symptoms on the part of these organs.

Extremely frequent are complaints which depend on an implication of various nerves of the lumbar and sacral plexuses, or of the corresponding portion of the lumbar cord, such as neuralgias of various kinds, hyperæsthesia, more rarely paralytic symptoms (in the lower limbs or bladder). There is no doubt that vaso-motor disturbances, even menorrhagia and metrorrhagia, may originate in disturbances of these nerve tracts.

There are very frequent disturbances in nerve tracts which are remote from the centre of the sexual functions. Neuroses of the stomach and larynx are especially frequent. There is no spinal or cerebral nerve which may not be affected. For example, trigeminal neuralgia is observed not infrequently. In recent times attention has been called to implication of the special senses, the eye, ear or even the nose. That the psychical sphere may be implicated should be taken into consideration, not alone by gynecologists but also by alienists.

EXAMINATION COUCH.—OPERATING TABLE.

Physical exploration requires certain preliminaries, among which the choice and arrangement of the position of the body are especially important. The position suitable for gynecological diagnosis may not infrequently be assumed on a sofa or bed, but in difficult cases, especially when instrumental examination is made, such modifications are required that it is simpler to use a suitable couch at the start. Palpation and combined examination through the vagina or rectum and abdominal walls may be made tolerably well when the patient is in bed. But if the case to be examined is at all obscure, if we must search for the pelvic connections of an abdominal tumor or for the ovaries, or if we must merely introduce a speculum, the bed must be specially prepared; it must be raised and pushed towards the light. In short, the inconveniences are generally so great that it is employed for finer methods of examination only in case of necessity, if the patient is unusually timid and anxious, or a suitable table cannot be obtained.

Any firm four-cornered table, from 70 to 80 cm. high, forms a perfectly suitable examination couch and even suffices for almost all operations. If it is covered with a blanket, and a few pillows, and a couple of substantial chairs are at our disposal, the most varied positions may be assumed.

Numerous, in part very complicated, examination-tables and operating-tables have been constructed, in the shape of a chair, divan, etc. From the fact that they are made to resemble an ordinary piece of furniture, their transformation into an examination couch is often so complicated as to terrify the patient and to be inconvenient to the physician. A four-cornered table, 60 to 65 cm. broad, with an inclined plane, which may be placed at any angle, as a support for the back, together with firm pillows and footboards, which may be placed higher or lower or removed altogether, is convenient and suitable for all purposes. That portion of the table upon which the buttocks lie, should not be too long. The distance between the anterior edge of the table and the beginning of the inclined plane should be from 30 to 35 cm. If this distance is greater, it is often difficult to teach the patient to lie sufficiently forward and to remain in that position (Fig. 1).

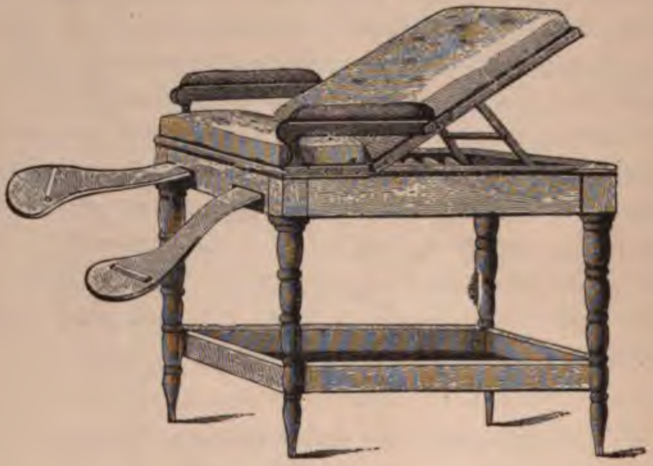

FIG. 1.

This table may be employed for all minor and even for the majority of major operations on the introitus and vagina, for extirpation of polypi, amputation of the cervix, etc.

In laparotomies it is best to employ a simple four-cornered, firm, somewhat high table, the operator standing at the long side. A very convenient laparotomy table is that devised by Péan, in which the patient's lower limbs are placed in two grooves, which may be turned in any direction. The operator sits upon a stool between the legs of the patient. We have had an operating-table made on the same principle and are very well satisfied with it (Fig. 2).

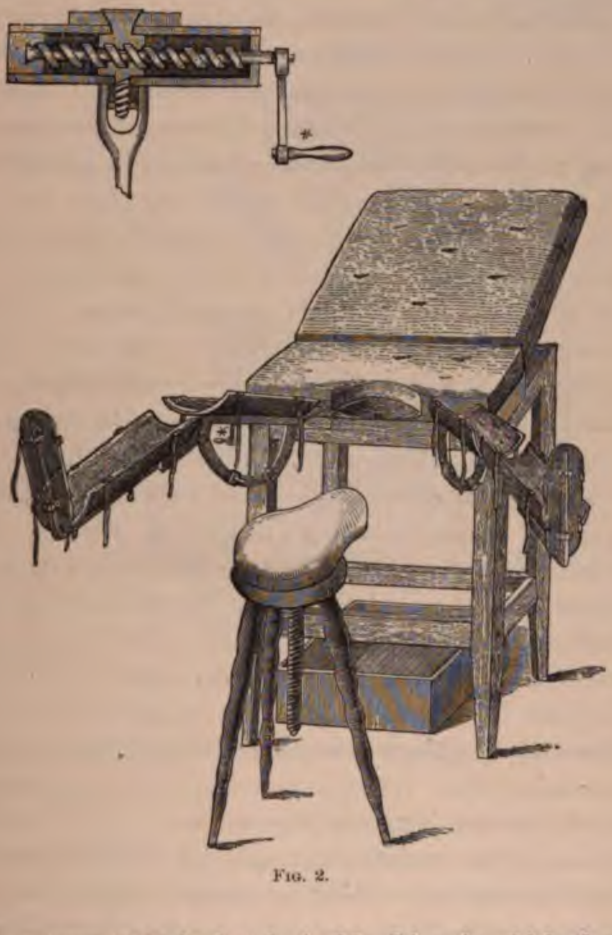

Fig. 2.

POSITIONS OF THE BODY.—ERECT POSITION.

Certain positions are preferably employed for gynecological examination. It is a peculiar fact that there is considerable difference in the choice of such positions among different nations. The English prefer to examine and operate in the lateral position, the German and French in a sort of "operation for stone" position, the Americans in dorsal decubitus, or a sort of latero-abdominal position. Certain methods of examination can be performed properly only in one definite position. Moreover, certain morbid conditions are best recognized in certain positions. It is important to learn the effects produced by changes in position upon the position of the organs, new growths, painful sensations, etc. A knowledge of the anatomical and physiological peculiarities of the various positions is therefore necessary. We should be able to employ all.

Erect Position.[1]—In a comfortable standing position a well-formed, healthy woman presents a moderate convexity of the abdominal region, a moderate lumbar concavity and the opposite dorsal curvature. The posterior surface of the sacrum forms a slight angle to the vertical, *i. e.* it is almost at right angles to the horizon. A plumb line dropped from the most projecting spinous process of the dorsal vertebræ will touch the most projecting part of the sacrum or fall a little behind it. A vertical plane applied to the anterior border of the trochanters touches the manubrium sterni or passes a little behind it. A plumb line dropped from the middle of the lateral part of the thorax passes a little behind the posterior border of the trochanters. If the pelvis is carefully examined, it is found that the posterior wall of the symphysis is about at an angle of 45° to the horizon. The anterior superior spinous processes of the ilia are in a vertical plane with the tubercula pubis. The tip of the coccyx is somewhat higher than the lower border of the symphysis (Fig. 3).

The tension of the abdominal walls and the intra-abdominal pressure are increased in comparison with all recumbent positions.

According to Kuestner[2] the fundus, in the erect position, sinks downwards, while the portio vaginalis ascends and moves somewhat backwards.

---

[1] In Fig. 3, the walls of the bladder are contracted, and the lowermost part of Douglas's *cul-de-sac* contains a few bands of adhesions.

[2] Otto Kuestner, Untersuchungen u. d. Einfluss d. Koerperstellung auf d. Lage des nicht graviden, bes. des puerp. Uterus, Arch. f. Gynæk. Bd. XV., Heft. I.

It is then somewhat behind and above a line drawn through the spinæ ilei. In puerperal women, with their flaccid abdominal walls, the entire organ passes somewhat backwards. In virgins this movement is very slightly marked. If the bladder is very full, so that the fundus cannot sink forwards, the portio vaginalis simply descends. If the ligaments are flaccid and the position of the uterus had been normal, it merely descends.

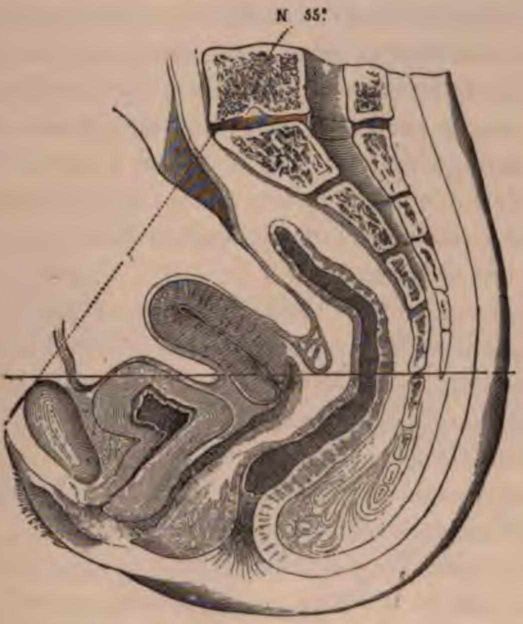

FIG. 3.

If the cervix is fixed, more marked ante-flexion ensues on assuming the erect position.

Individual deviations, between normal limits, from the described erect position are quite frequent. But more marked and constant differences are always noteworthy, especially marked prominence or pendulousness of the abdomen, considerable lumbar lordosis, bent-over-forwards or backward position of the trunk, considerably diminished or increased flexion of the pelvis. The latter is shown by the more horizontal position of the posterior surface of the sacrum, the higher position of the tip of the coccyx compared with the lower border of the symphysis, projection of the anterior superior spinous processes of the ilium in front of a vertical plane passed through the tubercula pubis, approximation of the symphysis to the horizontal, etc.

Abnormal conditions in the bones, joints or muscles, inflammatory processes in the peritoneum, pelvic enlargements of various kinds, etc., impart to the whole vertical position a very peculiar, often different appearance. This may lead to the discovery of important anomalies which are connected directly or indirectly with the sexual system. Or a symptom which we generally attribute to an affection of this system may thus find another explanation—for example, the pain in the small of the back, which is sometimes the result of great relaxation of the abdominal muscles.

Circumstances do not always permit of the great exposure which is desirable in such an examination. But even a partial removal of the clothing enables us to form a certain opinion concerning the position of the pelvis, spinal column and other points; it is also advisable to take the patient's gait into consideration.

Careful examination of the generative organs in the erect position is especially necessary, when we wish information concerning the presence or degree of an existing prolapse of the vagina and uterus. This mode of examination may also be important in versions and flexions. Examination of the mobility of the uterus, its weight, the mode of change of position in passing from the recumbent to the erect position when tumors are present, sometimes furnishes valuable data.

If we wish to relax the abdominal walls to the greatest extent possible in the erect position, while we are performing palpation the patient should bend over forward while supported by a third person.

POSITIONS OF THE BODY.—DORSAL DECUBITUS.

Complete dorsal decubitus with extended lower limbs is but little employed in gynecological examinations and operations. We will, therefore, consider it chiefly as the starting-point for the other positions which are more frequently employed.

If an individual lies on a firm horizontal support, the trunk is supported mainly on the lower part of the posterior surface of the sacrum, the most prominent dorsal spinous processes, and the adjacent parts.

The abdomen presents only a moderate curve, may even be flat or concave outwardly; the latter occurs only under unusual conditions

The inclination of the pelvis (*vide* Fig. 4) is the reverse of that in the erect posture. The upper border of the ramus pubis is the highest point of the superior strait, the promontory the lowest. The plane inclines from before backwards and downwards. The posterior border of the ramus forms, as in the erect position, an angle of 45° to the horizon, but this angle is open posteriorly. The portio vaginalis is situated in a line passing through the spinæ ischii. The lumbar vertebræ form an angle of 135° with the conjugate axis, and the distance of the upper border of the ramus from the middle of the third lumbar vertebra is about 20 cm. The tension of the abdominal walls and the intra-abdominal pressure are much less than in the erect position.

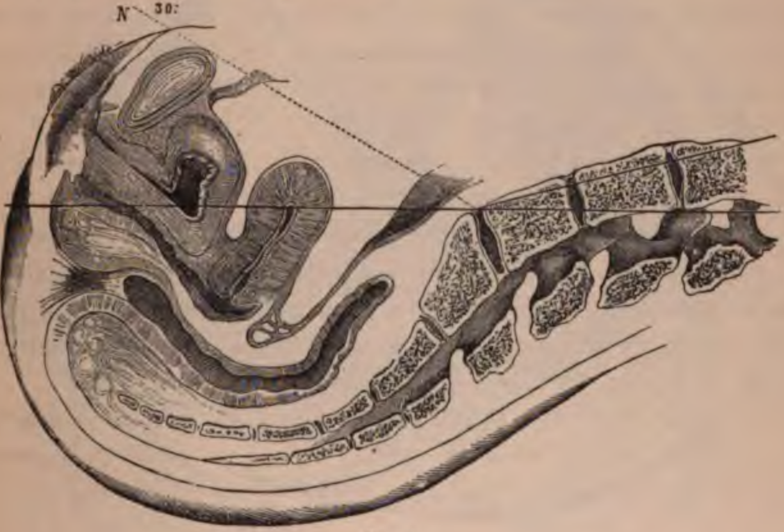

FIG. 4.

In order to make simple dorsal decubitus useful for gynecological purposes, it is changed in two ways. The lower limbs are flexed at the knees, and the thighs are drawn forcibly against the abdomen. This is done, at first, by mere flexion of the femurs at the hip joints. But when the maximum of this movement is reached and the attempt is still continued, the pelvis is flexed upon the spinal column. In the second method the thighs are drawn up somewhat against the abdomen, and moderate flexion at the knees is performed. But the chief change of position consists in raising the upper part of the trunk, so that it is midway between sitting and lying down.

Whichever is done, the angle between the spine and pelvis is made smaller. The same movement also takes place in the intervertebral cartilages. But the starting-point of the movement varies: in one it is the pelvis, in the other the upper part of the spine. The elevation of one or the other part also produces differences in the position of the pelvic and abdominal viscera, and in the tension of the abdominal walls and intra-abdominal pressure, circumstances which are important in gynecological examinations.

If the first modification is properly made (Figs. 5 and 6, ***breech-dorsal position***), the upper part of the trunk remains upon its horizontal sup-

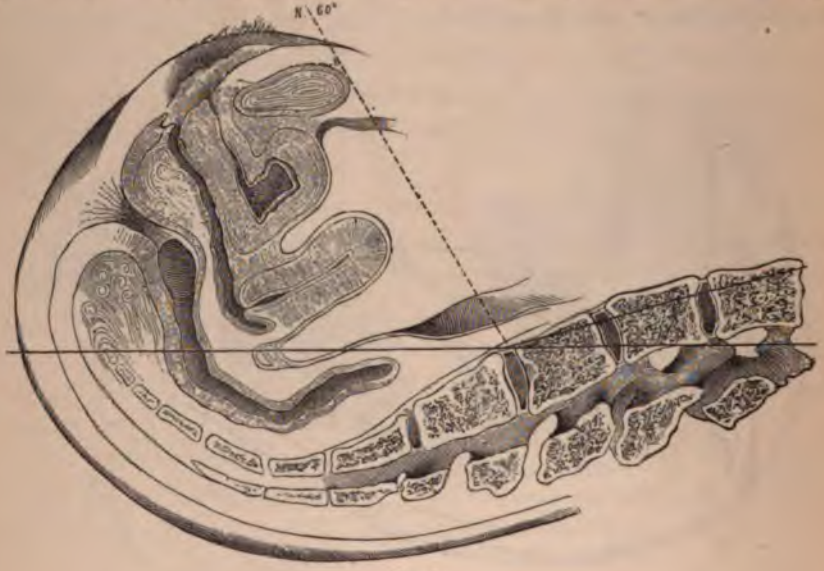

FIG. 5.

port, the head being merely supported by a small pillow. The knees being flexed, the thighs are drawn up upon the abdomen. This is done by two assistants, who apply one hand from without and over the thigh, to the inner surface of the leg, while the other hand holds the latter firmly around the ankle. At the same time the limbs are abducted to the requisite extent, in order to expose the vulva. Every ordinary four-cornered table is suitable for this purpose. The patient should be placed, from the start, in such a position that the introitus vaginæ projects somewhat beyond the edge of the table.

A special apparatus has been devised for the fixation of the limbs; for example, vertical supports at the edge of the table, with cushioned half-rings, into which the knees are placed. Two assistants are preferable, since any desired modification may be carried out by them. If they grow tired or their aid is needed for other purposes, they may place the patient's leg over the shoulder. In this position the vulva is high above the support. The body is no longer supported on the lower part of the sacrum, but on its upper part, on the posterior portions of the crests of the ilia, or even still higher. The angle of inclination of the pelvis is very much enlarged, so that the superior strait makes an angle of 50 to 60° or more. The ramus approaches the horizontal or even becomes entirely horizontal. The angle between the conjugate and the lumbar vertebræ may sink to 110°, *i.e.*, only 25° different from that in the simple horizontal position. Corresponding to this the distance between the ramus and third lumbar vertebra is lessened 1 to 2 cm. or more. The height of the lumbar spine is somewhat diminished anteriorly by compression of the intervertebral cartilages. Hence that portion of the abdominal cavity which is enclosed

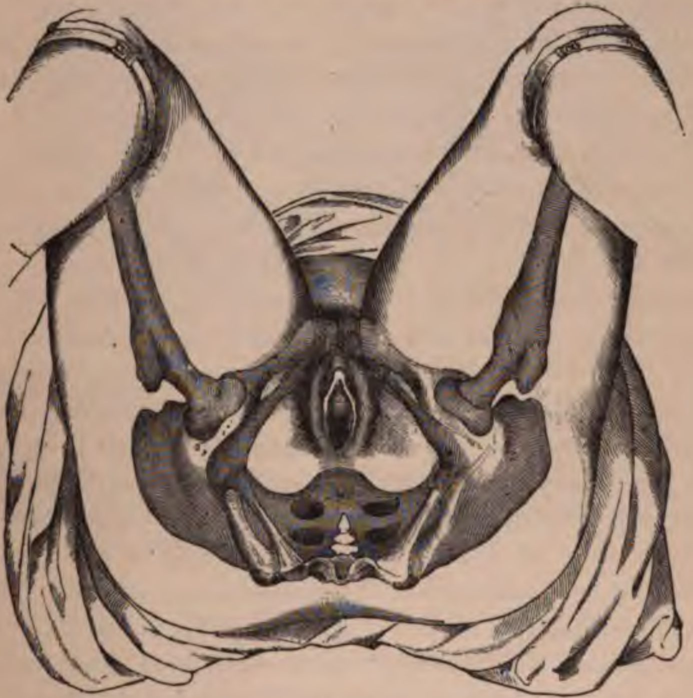

FIG. 6.

by osseous parts is made considerably smaller. The vagina runs obliquely from above downwards. The tension of the abdominal walls and the intra-abdominal pressure are diminished. Forcing this position, however, entails certain evils as regards palpation. As a general thing the abdomen is best palpated when the thighs are held vertically to the couch. Excessive elevation and flexion of the pelvis against the spinal column cause increase of the abdominal pressure by excessive diminution of the bony abdominal cavity. The position is admirably adapted to direct measurement of the conjugate axis. It also possesses great advantages in combined examinations through the vagina or rectum and abdominal walls, and in the measurement of the oblique conjugate.

This position often suffices when carried out less completely. Thus it is often sufficient to draw the thighs of the patient, who retains the horizontal position, strongly against the abdomen, and to support the feet upon the table.

The second modification of the dorsal decubitus, which we will call the *lithotomy position,* differs in many respects from the position just described. If in an individual who lies upon an horizontal support, the trunk is lifted up, the pelvis and trunk as a whole will rotate upon the heads of the femurs, so that the inclination of the pelvis is diminished. At the same time the inclination of the spine to the pelvis also changes. The angle between the conjugata vera and the lumbar vertebræ diminishes, and hence the distance between the symphysis and the lumbar vertebræ. Partly on account of this diminution of the bony abdominal cavity, but especially on account of the effect of the weight of the thorax, which comes into play more and more the further the trunk is elevated, the intra-abdominal pressure is increased, and hence this position is less adapted than the previous one to examinations in which abdominal palpation plays a part.

The lithotomy positions, in which the thighs are flexed upon the trunk, the knees flexed, and the limbs abducted, vary extremely, according to the degree of elevation of the trunk, flexion of the thighs, etc.

We will here describe a lithotomy position (Fig. 7), in which the trunk rests upon an inclined plane at an angle of about 20°, the thighs are drawn moderately upon the abdomen, the legs are moderately flexed, and the feet are upon a horizontal plane with the sacrum. As a general thing this position is very comfortable for the patient, and hence is employed a good deal, with modifications, in obstetrical and gynecological examinations. The inclination of the pelvis is then about 20°, the angle between the conjugate and lumbar vertebræ 125°, the distance between the symphysis and lumbar spine is about 1 cm. less than in the horizontal position. The symphysis presents a greater angle towards the horizon. The vagina passes almost antero-posteriorly and only a little from above downwards.

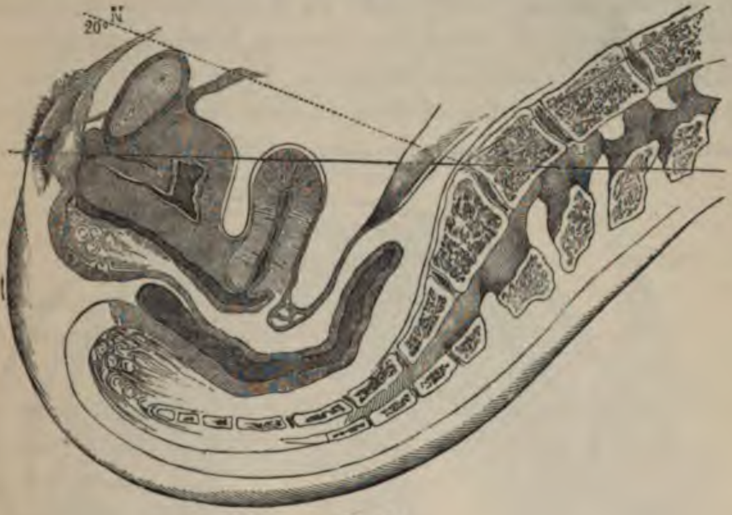

FIG. 7.

POSITIONS OF THE BODY.—THE ABDOMINAL POSITION.

Abdominal decubitus, in the true sense of the word, in which the abdomen itself rests upon the examining couch and, together with the anterior wall of the thorax, forms the support for the trunk, is occasionally useful, but only for a few purposes, such as examination of the spine, the posterior wall of the pelvis, and the back. On the other hand, we more often employ positions in which the supporting points consist of the flexed knee and the elbows or head and shoulders. These positions vary according to the degree of flexion of the thighs and the position of the arms. We will only consider that position in which the thighs are almost or entirely vertical upon the horizontal couch. But great differences may be presented even in this position. If the trunk rests upon the elbows, while the arms are at right angles to the table, as in the knee-elbow position proper, the pelvis will be higher than the thorax. But this difference will increase when the arms are extended or abducted, and then the head furnishes the point of support for the upper part of the trunk.

We will take as the prototype, from which modifications may be readily deduced, a position in which the thorax is tolerably, though not extremely low, as compared with the pelvis. (Figs. 8 and 9.)[1] The lower part of the posterior surface of the sacrum and the posterior perineum is turned directly upwards, while the anus, anterior perineum and introitus vaginæ are approximately at a right angle to the table. The entrance to the pelvis is directed towards the couch, but forms an angle of 10 to 20° to the horizon. The superior strait descends from the promontory towards the symphysis. The latter approaches the vertical. The angle between the lumbar vertebræ and conjugata is noticeably smaller, and may even fall to 110° if the thorax is very low. Hence there is also a diminution of the bony abdominal space. The sagittal diameter of the sternal end

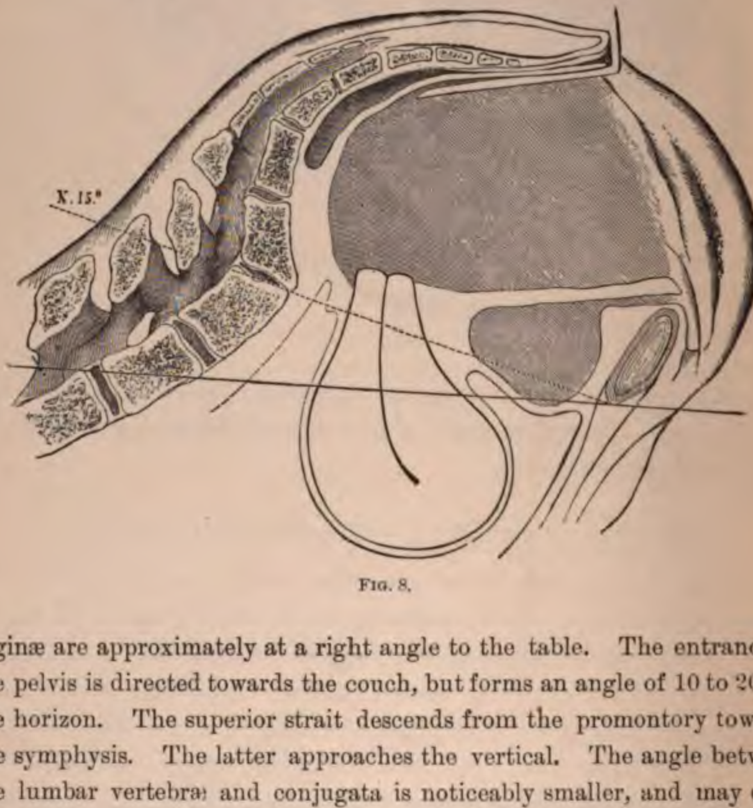

FIG. 8.

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[1] Fig. 8 is schematic. But the examination of a rather old puerperal woman served as the basis for the position of the uterus and vagina; hence the large size of the former.

of the abdomen is enlarged, the thorax is in the inspiratory position, the sagittal diameter of the abdomen above the symphysis is diminished.

In such a position, the deeper parts (thorax, abdominal walls, viscera) must exercise traction upon the higher parts in the direction of the line of gravity, as soon as the latter are not sufficiently supported. Hence the intra-abdominal pressure is very much lowered, unless the abdominal walls are unusually tense, or the abdominal cavity is unusually full. The pressure is generally lower than that of the atmosphere. The vagina fills spontaneously with air, if the introitus is not very narrow and the folds of the mucous membrane are not applied very firmly to one another. If the anal sphincter is very flaccid or torn, air also enters the rectum. If a catheter is introduced into the bladder, air generally enters the latter with an audible sound, while, in many cases, not a drop of urine is discharged, although the bladder may be very full. The uterus sinks towards the abdominal cavity, so that the portio vaginalis is not infrequently found near the promontory, or even outside of the true pelvis.

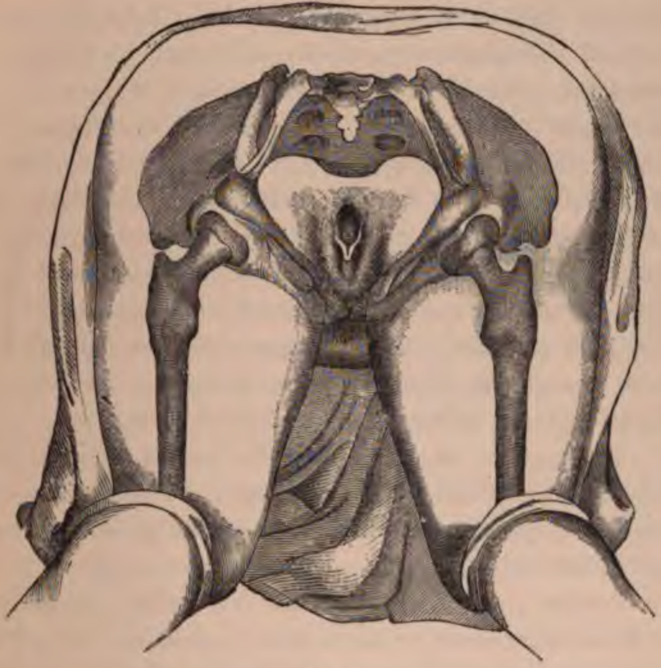

FIG. 9.

If the perineum is lifted up by means of a speculum, the anterior wall of the vagina is seen to run in a horizontal direction or even downwards, while the portio vaginalis is again somewhat closer to the floor of the pelvis. Much depends, in this respect, on the respiratory movements, the greater or lesser tension of the abdominal walls.

This position probably will not come into general use in examinations and operations. Despite the great diminution of intra-abdominal pressure, palpation of the abdomen is rendered difficult from the fact that the hand must support the weight of the abdominal walls and viscera. Under certain circumstances, however, abdominal decubitus possesses great advantages. A tumor which is situated deep in the abdomen falls by its own weight towards the exploring hand, and thus becomes accessible to examination. Even the mode of dislocation of an organ (the uterus), or of a tumor during transition into this position, is of interest. The uterus, which was firmly wedged in by a tumor, may be rendered movable by the sinking of the tumor. In some cases the inspection of the posterior or even the anterior wall of the vagina is made easier by the abdominal position. It possesses great advantages when it is difficult to fill the bladder and rectum with fluids. Replacement of a retroverted or retroflexed uterus may also be very much facilitated by this plan or may be possible in this position alone. Filling the vagina or rectum with air at the same time will greatly aid the replacement. Campbell recommends the knee-shoulder position, and filling with air, as the sole means of replacement before the introduction of pessaries, and as an aid in the employment of other plans of replacement. Even when the pessary is in position, a temporary resort to the posture in question and to distension with air, is often very advantageous. In milder cases this alone suffices, and is even useful in more serious conditions, in which, for certain reasons, pessaries cannot be introduced. Campbell[1] has devised a speculum-like instrument, which is used by the patient to permit the entrance of air into the vagina, after assuming the knee-shoulder position. This should be done at night before going to sleep. The patient may then assume a more comfortable position.

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[1] Campbell, *Atlanta Med. and Surg. Journ.*, June, 1875. *Trans. of the Amer. Gynecol. Soc.* Vol. I., 1877. No. 198.

POSITION OF THE BODY.—LATERAL AND LATERO-ABDOMINAL.

Any horizontal surface, which is sufficiently elevated, is adapted for securing these positions. In simple lateral decubitus, the crest of the ilium and the shoulder region serve as the main points of support of the trunk. The head may be somewhat raised by means of a pillow, but the thoracic region should not be elevated. In order that the entrance to the vagina, which must correspond to the edge of the table, should be visible, the thighs must be flexed on the abdomen. The legs are also flexed. This position of the body is usually inconvenient to the patients after a while, and then they attempt to draw the buttocks away from the edge of the table, in order that the legs may be supported, even when flexed to a less degree. A chair or little table may, therefore, be placed at the corner of the couch corresponding to the patient's legs, and the latter are placed upon it, or they may be supported by assistants. At least such assistance becomes necessary in prolonged operations. If the trunk is at right angles to the edge of the table, and this, as usual, is *vis-à-vis* to the window, the introitus will not be directly opposite to the window. Either the trunk must be placed obliquely to the edge of the table, or the latter must be placed obliquely to the window, in order that the parts may be open to inspection.

In this position the entrance to the pelvis is approximately vertical to the horizon. The spinal column and pelvis are strongly flexed upon each other. The intra-abdominal pressure is diminished, and may even become negative.

This position is suited, or at least, will suffice in many cases, for the application of certain methods of inspection, especially for the introduction of specula. Sometimes the right, sometimes the left lateral position may be employed. It presents few advantages for other methods of examination. It is only in percussion and palpation of the abdomen that a position on one or the other side is sometimes necessary, in order to demonstrate developing changes in percussion, fluctuation, and the position of tumors. The lumbar region and loins are often palpated to advantage in this position, the patient being generally placed upon the side examined, in order that a tumor which may be present, or an enlarged organ, may thus approach the palpating hand on account of its weight.

The latero-abdominal or Sims's position (Fig. 10) is intermediate between lateral and abdominal position. The examining table, its position, and the position of the trunk and limbs are approximately the same as in lateral decubitus. But the position of the trunk is changed, owing to the fact that the patient places the lowermost arm behind the back, and the upper shoulder is depressed as much as possible. The trunk thus rotates on its long axis, and the anterior surface of the thorax and abdomen are directed more inferiorly. The pelvis follows this movement and the plane of entrance no longer is vertical, but forms an obtuse angle to the horizontal, passing downwards from one side to the other. Hence the superior strait is directed somewhat downwards, and the posterior surface of the sacrum is directed somewhat upwards. Corresponding to this the posterior vaginal wall looks upwards, the anterior wall downwards. Hence the latter is drawn down by the weight of the abdominal walls and viscera. But the effect is not so marked as in the knee-elbow and allied positions, since the thorax is very little or not at all lower than the pelvis, and its weight does not aid in the traction. The intra-abdominal pressure is lower than in the dorsal and simple lateral position, but is greater than in the abdominal position proper. But it is often less than that of the atmosphere, so that the vagina fills spontaneously with air, or, at least, this distension with air after artificial dilatation is greater than would

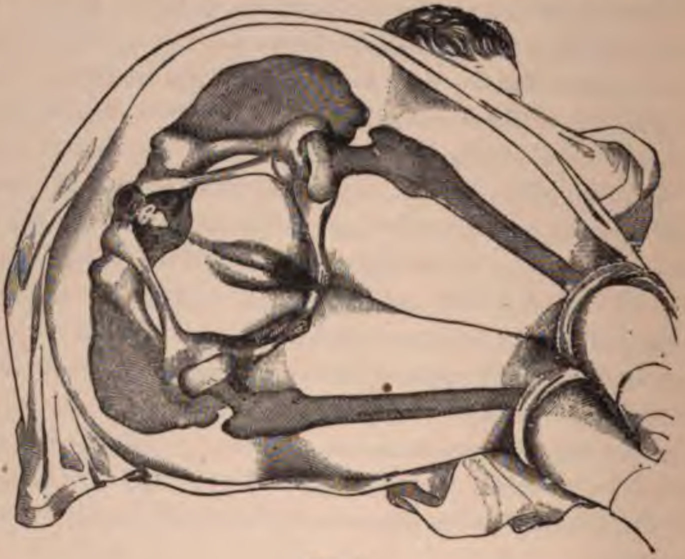

FIG. 10.

correspond to the dilatation alone. The influence of the respiratory movement in this position is often annoying. It is so much more marked because the bony abdominal cavity is diminished in size by the marked flexion of the spinal column on the pelvis. In restless, timid individuals the anterior vaginal wall is violently depressed or raised during inspiration and expiration.

Sims's position was mainly employed by its discoverer for ocular examination. It offers no advantages for other methods of examination. It is very well adapted for the introduction of the speculum.

ANÆSTHESIA.

We are often compelled to anæsthetize patients for purposes of examination. Certain affections of the external genitals, urethral meatus, anus, such as fissures, papillary excrescences, vaginismus, spasm of the sphincter, may render exploration of the parts without narcosis entirely impossible. Even abdominal palpation is occasionally very much impeded or entirely prevented by great tenderness as the result of hyperæsthesia, or peritonitic irritation.

Certain methods of examination, such as manual exploration of the bladder or rectum with the entire hand (both are used very rarely), are very painful in themselves.

In virgins, our respect for modesty often induces us, apart from the painfulness of the exploration, to produce anæsthesia. Finally, we may be led to do this by the necessity of producing complete relaxation of the muscles, especially of the abdominal walls. Very nervous and excitable, or awkward, unintelligent individuals are unable to follow the directions of the patients with regard to respiration and abdominal strain. In others the abdominal walls are very firm, thick and rigid, and extreme relaxation is requisite in order to attain any result.

Similar factors are often decisive in operative procedures. In very nervous individuals we are often compelled to employ anæsthetic agents, even if the operation is very slightly or not at all painful, in order to secure sufficient quiet, especially in order to expose the field of operation. Fissures and painful spots on the external genitals will induce us to employ narcosis, in order to effect the same object, if we intend to operate upon the cervix.

But the most frequent cause which leads us to employ anæsthetics is the painfulness of the operation. In all operations upon the external genitals, introitus, near and upon the urethral meatus, anus, in all laparatomies, etc., the operation is often impossible without narcosis, or would be even more dangerous than with it. The danger of fatal shock in such cases is no slight one, if anæsthesia is not employed. In addition there is the danger of disagreeable nervous disturbances, even increasing to insanity, if too much is expected of the patient as regards the tolerance of physical pain and mental excitement.

There are few absolute contra-indications against anæsthesia. Among them we would place advanced fatty degeneration of the heart; contrary to former opinions, valvular lesions of the organ appear to be less important. The structure of the heart muscle, whether valvular disease is present or not, appears to be a more important factor. This is also true of changes in the arteries. Marked rigidity of the vessels makes the danger at least decidedly greater. Diseases of the respiratory organs, such as pleuritic exudations, chronic catarrh with emphysema, or goitre which compresses the trachea more or less, may contra-indicate anæsthesia. In such cases we are sometimes helped out of the dilemma, by the fact that severe affections of one or another kind constitute a contra-indication to the operation. If this is not the case, it is advisable, in these diseases of the circulatory apparatus, to obtain the advice of a specialist.

Among other contra-indications, are conditions of great exhaustion following hemorrhages, digestive disturbances, vital losses, as the result of the disease which is the object of our treatment, etc. In such cases we must, unfortunately, often run the chances. If we should often decline an operation for this reason, we would allow many patients to pass to the grave who could have been saved by the operation. Our judgment will be determined to a certain extent, by a careful decision between the existing condition of exhaustion on the one hand, and the evil results of narcosis and the operation (its duration, the probable loss of blood, the injury inflicted, etc.), on the other hand. Not alone the effect of anæsthesia, but of the surgical operation itself, must be weighed in the balance. A marked tendency to syncope is a factor which must be taken into careful consideration, especially if it is not merely the outcome of a nervous disposition.

Cases of death, which occurred some time after ether or chloroform anæsthesia, with complete anuria, have been recently described. The patients suffered from degeneration of the kidneys, and hence care in this particular is to be recommended.

The choice of the anæsthetic agent is of great importance. We need only consider chloroform and ether. In addition to their peculiar different physiological effects, various practical and technical conditions must be taken in consideration. If we disregard the latter for the present, we must remember, in selecting one of these agents, that chloroform diminishes the activity of the heart and the blood pressure, while ether, on the other hand, not infrequently increases them, at least if not employed for too long a period. The action of the latter upon the heart can be better followed, while the injurious effect of chloroform often occurs rapidly and unexpectedly. Death from primary syncope is much more frequent after the use of chloroform. There is probably no difference between them as regards primary asphyxia, but this is less dangerous than syncope. One of the auxiliary effects of ether, which is very prominent in certain individuals, viz., profuse secretion of the salivary glands and bronchial mucous membrane, is often extremely annoying. The after-effects, vomiting, depression, etc., are generally much slighter after the use of ether than of chloroform. Chlormethyl has offered us, after a long series of trials, no special advantages. We prefer ether for protracted operations, especially when the patent is weak and anæmic. Our opinion has been decided, among other things, by experiences in which we observed syncope in a patient during chloroform anæsthesia, discontinued the operation, and later were enabled to carry it out uninterruptedly under ether, or at once exchanged the chloroform for ether and completed the operation. We have had no experience with the combination of both agents. But we would here state that they may only be used alternately, in so far as chloroform is first administered and then ether. If the reverse is done, there is danger that the reflex irritability of the respiratory organs will be diminished to such an extent by the chloroform, that profound conditions of asphyxia may develop from the excessive secretion of the bronchial mucous membrane induced by the ether.

Various opinions are entertained with regard to the degree to which narcosis is to be carried. Some recommend profound anæsthesia, in which reflex movements cease almost entirely; others do not go so far. We must individualize. A certain reflex action may be very useful, another very injurious, both as regards the performance of the operation, and also as regards the life of the patient. In the latter respect we need only refer to abdominal strain in laparotomy, or to spasm of the glottis, which is apt to occur in incomplete anæsthesia, when especially irritable or sensitive parts of the body are the site of operation. In the former respect we are reminded of the disadvantage attending the complete cessation of reflex movements, if mucus or a foreign body is lodged in the respiratory tract. As a general thing profound anæsthesia seems to us to be preferable, such conditions as those last mentioned being, of course, taken into consideration.

With regard to the technique and to the assistance to be rendered in threatening accidents, we will refer only to a few main data, since a detailed consideration of the subject is not in place here.

In the administration of ether the head must be somewhat raised, while chloroform is generally given when the head is not elevated, or is even lower than the rest of the body.

The anæsthetic should always be in the hands of an experienced assistant, who concerns himself solely with its administration. He should have at his disposal a gag, tongue-depressor, and sponge-holder with a firmly fastened small sponge for cleaning out the pharynx. The latter is especially necessary in ether narcosis. In addition a hypodermic syringe and tincture of musk should be held in readiness.

Junker's apparatus, which was designed originally for chlormethyl, is now employed a good deal for chloroform anæsthesia. (Fig. 11.) It consists of a cylindrical, graduated glass tube A, into which the fluid is poured. The assistant fastens this by means of a hook to a button-hole in his coat; the rubber bag B, with an opening at *b* is compressed at certain intervals, corresponding to the inspirations, and then let go. In this way air is pumped into A, which is filled with the anæsthetic agent, and, mixed with the vapor of the preparation, passes through the tube *c*, towards the mask C. This mask possesses a suitable cavity and covers the patient's nose and mouth. It contains openings through which the expired air and gas may escape. The regulation is effected by the greater or less vigor with which the assistant compresses the bulb, and also by the occasional entire removal of the mask. Comparatively little of the anæsthetic agent need be used. Olshausen reports a case of asphyxia which resulted from the pumping of the anæsthetic fluid into the mouth. He recommends that a sieve be placed at the bottom of the mask. But it seems to us that it is entirely sufficient, in administering chloroform, to employ the ordinary, very simple apparatus of wire-work covered with a meshed stuff, into which some cotton is fastened with a pin.

The use of ether requires a more complicated apparatus, and we employ Clover's apparatus. Its employment is easily learned, and, as a general thing, anæsthesia may be produced by it in 4 or 5 minutes, though not if the patient is stupid and awkward. Under such circumstances, however, our purpose is also effected with greater difficulty by means of other agents and modes of application. After long trial we are unable to recommend the simpler methods of anæsthesia with ether, such as the employment of a felt cone, covered with some waterproof stuff. A much larger quantity of ether is consumed, and the evaporation is so great that the operator and his assistants are often extremely annoyed thereby. The apartment in which ether is administered should be large and well ventilated.

The ether must be pure and absolutely free from water, else a much longer time will be required to produce anæsthesia.

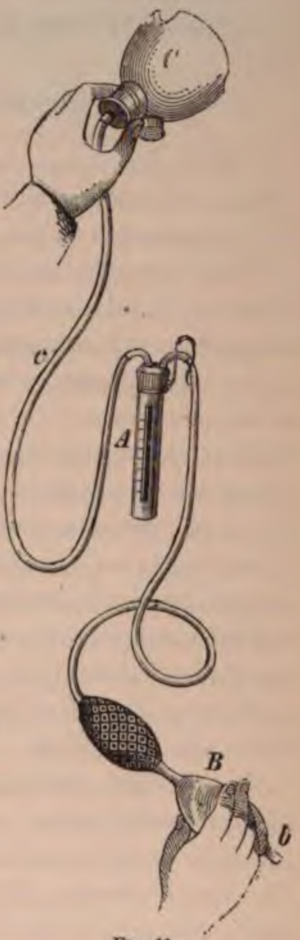

Fig. 11.

Classification of the Methods of Examination.

The methods of examination are divided into those which are performed with and those performed without instrumenst. The latter includes inspection when the exposure of deeper parts of the body is unnecessary, mensuration, auscultation and percussion, palpation of the abdomen, vaginal and rectal touch, and combined examination.

The discussion of instrumental methods of examination seems to us to be more suited to an anatomical subdivision. We will here consider the instrumental examination of the urethra and bladder, the vagina and portio vaginalis, the uterus and rectum.

EXAMINATION WITHOUT INSTRUMENTS.

INSPECTION.

Many important conditions may be determined, after sufficient exposure, by inspection in the erect position, or in ordinary dorsal decubitus. We should pay attention to deformities of the skeleton, especially the spine, of the pelvis and lower limbs, abnormalities of gait and position, pigmentation of the skin, changes in the breasts (marked swelling, enlargement of the veins, turgescence of the nipple and areola with marked pigmentation, prominence of the sebaceous glands). Upon the abdomen we should notice its prominence or sinking in, its uniform or irregular shape, circumscribed enlargements, the character of the umbilicus, the pigmentation of the linea alba, the striæ, the development of the veins, the influence of respiration on a prominence which may be present. The effect of changed position is also to be noted; the swelling is sometimes found to rise and fall synchronously with the action of the heart. Contractions of the abdominal muscles, fœtal movements or movements of the intestines, may be visible. The naked eye may also determine the relaxation or tension of the abdominal walls.

The lithotomy position suffices for inspection of the external genitals and surrounding parts. At the same time we may also examine the lower limbs (deformities, varices, œdema.) Then attention should be paid to the color, appearance of the inguinal folds, the appearance of the anus (prolapsus, folds of the mucous membrane, hemorrhoids, fissures, condylomata), the perineum, mons veneris, the closure or patency of the vulva, the size, flabbiness or turgescence of the labia, unilateral enlargements, œdema, varices of the labia, etc. The labia are then separated by means of two fingers of each hand, in order to obtain a view of the inner surface (color, secretion, fissures, ulcers,) the clitoris, urethral meatus, fossa navicularus, the hymen or its remains. In individuals who have borne children, and have a wide vulvar fissure, we are able to see, if the labia are sufficiently separated, the lower part of the vagina, the anterior wall with the carina vaginæ and that portion of the posterior vaginal wall which is next to the perineum.

Inflammations of the external genitalia, Bartolin's glands, ulcers and tumors of these parts, defects of structure, displacements of the uterus and vagina, and projecting tumors, may be recognized on inspection.

MENSURATION.

Apart from purely obstetrical examinations, mensuration is chiefly employed in order to determine the size, variety and growth of an abdominal enlargement. This can be done with a tape measure, which will, however, merely show the length of the different curves. In order to determine the chords we may employ the so-called cyrtometer or a flexible metallic strip. Both of the latter apparatus retain their curve after removal from the curved surface; the curvature may then be drawn upon paper and the chord measured.

With the tape we first measure the circumference at the umbilicus, then below and sometimes above it. From the greater dimensions of one or the other of these parts, we may draw a conclusion as to the situation of the tumor, or its development in the upper or lower part of the abdomen.

The difference between the distance from the umbilicus to the symphysis on the one hand, and to the ensiform process on the other hand, is also said to afford a clue as to the site and development of the tumor in the upper or lower part of the abdomen. Thus, the disappearance of the usual difference in favor of the distance between the umbilicus and ensiform process, *i.e.*, the equalization of both distances, or, still more, a predominance of the distance between the umbilicus and symphysis, testifies in favor of the situation and development of the swelling in the lower part of the abdomen. We may also infer its origin in a lateral region, if the distance between the anterior superior spine of the ileum, or the middle of the horizonal ramus of the pubis and the umbilicus, is greater than on the other side. We may also measure the distance between the spinous process of a vertebra and a certain point on the linea alba of one and the other side.

The greatest value of mensuration is the information which it offers us concerning the absolute size of a tumor and its growth, if the measurements are made at different times. But notable errors may result from the varying distension of the intestines with gas and fæces, the disappearance or increase of the adipose tissue. Mistakes may also arise from taking measurements in different positions of the patient. The circumference in the ordinary dorsal position with extended lower limbs, is different from that in the lithotomy position.

PERCUSSION AND AUSCULTATION.

The examination of the abdomen by the sense of hearing may be performed in the ordinary dorsal position. In the large majority of cases the stethoscope is preferable to immediate auscultation. This method is extremely important in the differential diagnosis of pregnancy, tumors and ascites. Percussion is performed in the same way as that of the thoracic organs. The pleximeter cannot well be dispensed with. As a general thing we should avoid forcible percussion, since even the sound over a solid mass may become tympanitic, on account of the resonance of the adjacent intestines, which are filled with air.

Percussion may define the boundaries of a tumor, but it is to be regarded chiefly as an auxiliary to palpation. The separation of a tumor from a certain organ is sometimes rendered probable by percussion, inasmuch as a tympanitic zone can be demonstrated between them. Percussion will also prevent us from mistaking the abdomen which is tympanitic throughout, or a certain part of it, for a tumor. This method is also valuable in detecting the presence of intestines between the abdominal walls and a tumor. Changes of the percussion note on changes of position indicate the presence of movable fluid in the abdomen.[1] If the distended abdomen gives a dull sound over both loins, the patient is placed on one or the other side, in order to convince ourselves of the disappearance or persistence of the dullness on the upper side. The pelvis is raised and the thorax lowered in order to determine whether the boundary of an area of dullness in the lower part of the abdomen passes down farther. The pleximeter is pressed in superficially or deeply, and the differences in the percussion note are noticed. It is sometimes possible to push away the loops of intestines which are situated in front of an enlargement, and not until this is done is dullness obtained. In ascites, even of a marked grade, loops of intestines, filled with air, may float on top if the mesentery is long. In this case, likewise, a dull sound is obtained only after the pleximeter is pushed in deeply. On the other hand, if the intestines are held down by a retracted, short mesentery, they do not reach the anterior abdominal wall, even if the accumulation of fluid is only moderate. The sound does not become tympanitic until the pleximeter is pressed deep in, and the fluid is thus pushed to one side. In rare cases percussion is performed directly upon the sexual organs, for example, in order to determine the presence of intestine in front of a prolapsus uteri et vaginæ.

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[1] This is not always true, since fluids or firmer masses within the intestines also follow the law of gravity. If the intestines are filled with water through the rectum, it will occupy the lowest part of the abdomen and only the obstruction caused by the mesentery will produce, on changes in position, certain differences when compared with free fluid in the abdomen.

Apart from the fœtal heart-sounds, auscultation is concerned chiefly with vascular murmurs, and with the friction murmurs of the roughened peritoneum. Vascular murmurs have been observed in the most varied conditions, in pregnancy, uterine tumors (in about half the cases, according to Winckel), and in ovarian tumors, in which they are much less frequent. Winckel found them twice in splenic tumors, once in a retroperitoneal tumor. Leopold noticed them in a cancer of the liver.

It may become necessary to ascertain the origin of vascular murmurs. Do they arise in a tumor or in a large artery of the abdomen or pelvis, which is compressed by a tumor? The following are mentioned as differential points: A murmur produced in a large artery is only audible in certain places along its course, in the median line of the abdomen, or in the groins (aorta, iliacs). It does not disappear after pressure with the stethoscope, unless the tumor, which compresses the vessel, is pushed to one side. The ear sometimes perceives a distinct shock. Systolic elevation of the tumor is sometimes visible. The compression is sometimes proven by the feebler pulsation in one crural artery. If the murmur developes, as in rare cases, in the epigastric artery, it is audible along the course of that vessel. The finger then detects a thrill in this artery, and may abolish the murmur by vigorous compression.

Murmurs within a tumor are usually more widespread, sometimes change their situation in the tumor, or in the abdomen, (from displacement of the tumor during changes in position), and can often be abolished by the pressure of the stethoscope. In one case Pernice found that a purring artery was the cause of the murmur in a tumor, and that pressure upon it through the vagina caused its disappearance. During pregnancy the purring arteries can be felt upon the uterus through the abdominal walls, or at the side of the cervix, and the arterial murmur may be checked by pressure.

NOTES.—Percussion is especially important in making a differential diagnosis between free and encapsulated fluid in the abdominal cavity. Auscultation is valuable in deciding between pregnancy and abdominal tumors, or when combinations of both are met with. Here the fœtal heart-sounds play the principal part, the vascular murmurs have less significance, because they are also noticed in the most varied conditions.

MANUAL EXPLORATION OF THE ABDOMEN AND PELVIS.

In determining the condition of the organs in the abdominal and pelvic cavities by the aid of the sense of touch, four parts are at our disposal: the abdominal walls, genital canal, rectum and urinary organs. If the abdominal walls alone are employed, the examination is known as palpation, if the genital canal or rectum is alone used, it is known as simple touch. Combined exploration is the term employed when several parts are examined at the same time. If we employ only two, we have six possible combinations: abdominal walls and genital canal, abdominal walls and rectum, genital canal and rectum, abdominal walls and urinary passages, genital canal and urinary passages, rectum and urinary passages. If we employ three parts for examination, we obtain four combinations: abdominal walls, genital canal and rectum; abdominal walls, urinary passages and genital canal; abdominal walls, urinary canal and rectum; urinary passages, genital canal and rectum. The ordinary combinations have been mentioned first, the others are rarely employed. But it is always well to be acquainted with them, since, in exceptional cases, they may furnish important information.

In all these modes of exploration, with few exceptions, it is desirable and even necessary that the intra-abdominal pressure and the tension of the abdominal walls should be as low as possible. This is principally effected by suitable position of the patient. This may often be secured in bed, but the exploration can be made better and more conveniently upon a special examining table. A sort of lithotomy position with moderately elevated trunk, the lower limbs being supported, flexed at the knees and slightly abducted, will generally suffice. If the patient is in bed, care should be taken that the buttocks are somewhat raised and rest upon a firm support. A breech-dorsal position is also often serviceable. Every muscular exertion on the part of the patient should be avoided as much as possible, since this is apt to call the abdominal walls into play. We should be especially careful that the patient be not compelled to keep the lower limbs in the desired position by muscular effort. If necessary the limbs must be supported by assistants. Semi-abdominal or complete abdominal positions can rarely be employed, although in them the abdominal pressure is least. The abdominal walls then support the weight of the viscera, and the hand which rests upon the abdomen must support or overcome this weight. But in many cases this difficulty is not very great, and examination in these positions can, therefore, be occasionally employed to advantage. Thus it may be important to determine the change in position of an organ or tumor arising from the change to one of the abdominal positions. In the knee-elbow position the uterus may be relieved from an incarceration caused by the weight of a tumor, and its size, mobility, etc., are, therefore, more readily examined.

Profuse evacuations from the bowels and the passage of urine not alone facilitate the examination, but also guard us against mistakes. In addition the patient should eat very little prior to the examination.

It is well known that exploration is very easy in puerperal women or in others whose abdomen has been previously distended, and the contents rapidly discharged. Such a condition may be approximately induced if the patient is allowed to drink a good deal, retains the urine for a long time, and discharges it shortly before the examination. It is still better to pump as much fluid as possible into the bladder and rectum, and to have it retained as long as possible. Or the vagina may be thoroughly tamponed; this also possesses other advantages to which we will return later.

Emotional excitement, dread of the examination and modesty almost always cause increased tension of the abdominal walls. At times the patients hold their breath, or breathe irregularly, and bring abdominal pressure so often into play that absolutely nothing can be effected by palpation of the abdomen. The ordinary devices, such as directing the patient to keep the mouth open and to breathe quietly, or diverting her attention by conversation, are often unsuccessful. But it will be often noticed that even if our object is not attained at the first examination, this is readily done in the subsequent one. It is, therefore, advisable to be very gentle if the patient is timid, and to defer success until the second exploration. The patient is then better acquainted with the physician, and the mode of examination, her diffidence has disappeared, she understands the physician's injunctions and is able to carry them out.

Advantage may sometimes be taken of nervous sobbing and crying. During the paroxysmal expirations which take place under such circumstances, the hand may be pushed in deeply without meeting with obstruction.

Roederer recommended for the detection of tumors deep within the pelvis, that the patient take full inspirations and that the receding abdominal walls be then followed during expiration. The hand should be kept firmly applied after the first expiration, so that the ground gained may be held during the following inspiration, and then the hand is pressed in more deeply at the next expiration. The most difficult thing to teach the patient, is to make full and deep expirations. In many this is entirely impossible, either on account of ignorance or deficiency in will power.

Hence we are not infrequently compelled to resort to anæsthesia. In difficult and important examinations, for example, in morbid conditions in which the question of operation arises, this may be indicated from the first. Likewise, if great sensitiveness of the abdominal walls, introitus vaginæ or rectum, great obesity or tension of the abdomen, etc., render the examination impossible, or at least very difficult. It is rarely possible to employ the urethra and bladder in examination, except after the administration of an anæsthetic.

PALPATION OF THE ABDOMEN.

The foregoing remarks will suffice as regards the position of the patient and other preparations. But it must be remembered that this examination can generally be made very well in an ordinary bed, the thighs being drawn up upon the abdomen, and the legs supported by a pillow which is shoved under the knees. The physician's hand should possess the ordinary temperature of the body.

The following is the technique: Palpation is usually performed by placing the palms of both hands or a part of them upon the abdomen without pressure; simple touch is practised only with the tips of the fingers. We test the thickness, consistence, tension and sensitiveness of the abdominal walls by palpating the different parts in a certain order, symmetrical parts especially being compared with one another. We should never omit to examine the inguinal region for hernia and glandular enlargements. These data can be determined without exercising any considerable pressure. If we encounter great sensitiveness, we must distinguish between nervous irritability and an inflammatory condition. In the former event, superficial palpation will often be felt very disagreeably, while deep pressure is better tolerated. If we have convinced ourselves of the presence of an inflammatory condition, especially within the abdominal cavity itself, strong pressure must be avoided. This always aggravates a peritonitis. Nor can we attain our purpose in this way, inasmuch as increased tension of the abdominal walls soon develops, while gentler methods will often enable us to define the boundaries of a tumor, or a circumscribed peritonitic exudation. If a swelling is present, its shape and size must first be determined by palpation, in so far as this has not been done previously by inspection. Its consistence and sensitiveness are then tested. It is especially important to determine its boundaries and its connection with or isolation from other parts. This is done by pushing the tips of the fingers as far as possible between the tumor and adjacent parts. A second measure consists in producing movement of the tumor by means of the hand or by the assumption of another position, or by moving some organ, which can be felt, or another swelling. We thus learn whether one or the other tumor can make independent movements. In this way we learn the absolute amount of mobility.

If the enlargement is situated deeply, it may not infrequently be pushed by one hand against the other. For example, if we wish to examine the lumbar regions, the fingers of one hand are placed in the loins and pressed forwards, while the other, placed in the flank, pushes the abdominal walls backward.

If the walls are yielding and the tumor is superficial, the latter may be seized, like the fœtal head, between the two hands, or the greater part may even be grasped in one hand, and its characteristics may thus be accurately noted.

In order to find adhesions of a tumor to the anterior abdominal wall, we should endeavor to slide the latter across the tumor, or *vice versâ*, or an attempt is made to lift up the abdominal wall in a fold. The abdominal walls may be stroked in order to obtain crepitation over rough parts of the peritoneum. The demonstration that a solid body is floating in a fluid is afforded by ballottement. The tumor is thrown, by a rapid movement of one hand, towards the tips of the fingers of the other hand, which are applied at a certain distance. Or a body which is situated low down in the abdominal cavity is thrown upwards; if it is floating in fluid, it first rises and then slowly sinks upon the tips of the fingers. In order to detect fluctuation one hand is applied gently upon the abdomen, and a blow is given with the tips of the fingers of the other hand upon a part situated more or less distant. Or both hands are applied to the abdomen and its contents are pushed somewhat rapidly by the tips of the fingers of one hand towards the other. Or downward pressure is rapidly exerted, and a retrogressive wave is looked for. Many mistakes are possible in the diagnosis of fluctuation. Thus, we must avoid mistaking it for the pendulous movements of the abdominal walls themselves.

SIMPLE VAGINAL AND RECTAL TOUCH.

As a general thing we must make it a rule in the exploration of the pelvic viscera to begin with this simple method, and then to employ the combinations. This is especially true if we desire to define accurately the position of the organs, such as the uterus, since the combined methods of exploration are apt to induce a change in the position of the organs. It is only when the results of simple touch are compared with those of a carefully performed combined examination, that a correct opinion may be performed. With regard to position and preparation in vaginal explorations, the same remarks hold good as in all other methods of examination. In certain cases we employ the erect position—for example, in cases of descent and prolapsus of the genital tract. The condition of an otherwise displaced organ in the vertical position may also be of interest; likewise the influence of this position upon the position of the uterus in the case of tumors. The patient leans against the wall or some firm object, and the physician kneels before her or sits upon a low stool.

The vagina is sometimes very short and firm, and this may give rise to considerable difficulty. In such cases rectal exploration should be adopted. But if vaginal touch seems to be very desirable preparation may be made by tamponing the vagina one or more times, with cotton or a rubber bag.

In this way even a very short and unyielding vagina may be prepared in a short time.

The following is the technique of examination: The well-oiled index finger is passed along the perineum towards the posterior commissure, pushes the latter downward, and thus glides into the vagina. The thumb is forcibly abducted, the other fingers are flexed into the palm of the hand, or extended in the perineal region. A less serviceable method is the touch with two fingers, but this may become necessary if the parts to be explored are situated very high. Whoever has short fingers will often be compelled to examine in this way: both hands must be trained in exploration, since, as a general thing, the right side of the pelvis can be examined better with the right hand, the left side with the left hand.

During the introduction of the finger, notice should be taken of the position of the introitus, the sensitiveness, narrowness or width, rigidity or relaxation of the tissues, the turgescence and secretion of the vulva. As the finger enters further the temperature and pulsation should be noted. When the portio vaginalis is reached, its position must first be determined, the line between the spinæ ischii recommended by Holst serving as the starting-point. One or the other spine of the ischium is readily found. Considerable deviations of the portio vaginalis from this line, either downwards, upwards, anteriorly or posteriorly, must be regarded as abnormal unless temporary displacement has been produced by marked distension of the bladder and rectum. Marked lateral deviations must also be noted. We then determine the length, breadth, thickness, and shape of the vaginal portion, the size, shape and direction of the os uteri, and the condition of its edges.

This is followed by exploration of the mobility and weight of the uterus. We should endeavor to raise it with the tips of the fingers, to push the neck to the side, backwards and forwards, and at the same time to determine the lever-like movement of the fundus in the opposite direction. At the same time its sensitiveness must be carefully noted.

We then proceed to the exploration of the fornix of the vagina. In the preceding examination we will have noticed the condition (denseness, hardness) of the parts immediately adjacent to the cervix. In examining the four segments of the fornix of the vagina (first the anterior and posterior, then the lateral parts), we must note their height and width, especially comparing the two lateral regions with each other in this respect, the character of the mucous membrane, and its sensitiveness. In addition, we attempt to follow the wall of the uterus anteriorly, posteriorly, and along the lateral borders as far as possible, and to ascertain the consistence, shape and sensitiveness of the uterus in these places. Anteriorly special attention is paid to the base of the bladder, thickenings of the vesico-vaginal wall, the thickened terminal portions of the ureters, and greater tenderness in these parts must not be overlooked.

Further examination of the pelvis must be left for combined exploration. As the hand is withdrawn from the vagina, the adherent secretion should be examined, and the odor noticed. Abnormalities of the pelvis should not be overlooked, even in non-obstetrical exploration.

Simple rectal touch may take the place of vaginal touch to a certain extent. The position of the vaginal portion can thus be determined, and the body of the uterus can be reached, if it is vertical or displaced backwards. But the rectum is mainly adapted to combined exploration.

COMBINED EXPLORATION.—PALPATION OF THE ABDOMEN WITH EXPLORATION THROUGH THE GENITAL CANAL.

We generally employ only the abdominal walls and vagina, more rarely the abdominal walls and the uterus, which has been artificially dilated. If the cervix happens to be sufficiently open for the introduction of the finger without such preparation, and if such dilatation would have been necessary for other reasons, the opportunity should not be neglected, since examination from the uterine cavity combined with palpation, may furnish satisfactory information concerning the condition of the walls of the organ.

The objects which we wish to secure are very numerous. We are almost always interested in determining the position, size and shape of the uterus, the similar conditions with regard to the appendages, especially the ovaries, and finally the characteristics of enlargements in the pelvic cavity. The manner in which these main objects may be attained will now be described, and it will then be easy to determine other data if these are required in exceptional cases. The uterus itself must first be considered. After the position of the portio vaginalis is recognized by the inserted index finger, the finger tips of the hand resting on the abdomen are moved backwards towards the third or fourth lumbar vertebra. Not until the posterior part of the superior strait is reached, are the tips of the fingers pushed downwards towards the entrance to the pelvis. If a hard body is felt, the inserted finger raises the cervix, and in this way we can best decide whether the uterus is situated between the hands. If the external hand is now gently carried more towards the pelvis, an idea of the position of the organs is obtained without notably changing the latter by the exploration. At the same time we must make use of the results of simple vaginal touch, which has informed us as to whether the anterior or posterior wall of the uterus can be reached more easily. Then greater external pressure is exercised, and the tips of the fingers are pushed between the body felt in the pelvis and the promontory, or between the former and the symphysis. At the same time it must be remembered that, in the former event, the body is pushed forwards and downwards; in the latter it is displaced backwards and even elevated—in other words, the uterus is either anteverted or anteflexed, or it is retroverted or made to assume a vertical position. This artificial displacement may be considerably increased by the inserted finger, if the latter pushes the cervix backwards or forwards. The consideration of these conditions seems to be very important, since without it an existing anomaly in the shape and position of the organ, particularly anteversion and anteflexion, may be incorrectly estimated. Even a normal uterus may be forced into such an abnormal position. If such an anomaly is present, it is apt to be regarded as greater than it really is, since it is artificially increased in order that we may perceive it well, and at the same time, in our endeavor to obtain information with regard to other points. This is further done by removing the finger from the cervix, and passing it to the fornix of the vagina anteriorly, while the external hand pushes the body in the pelvis downwards from its posterior surface. It is thus brought between the fingers, and its size, shape, mobility, sensitiveness and connection with the cervix, can be readily ascertained. Or the inserted finger is passed into the fornix of the vagina posteriorly, the outer hand pushes from in front, *i.e.*, it pushes the anterior wall backward and even downward; the body is thus brought between the fingers in another way, so that the above-mentioned characteristics can be examined.

A similar plan is adopted in lateral displacements of the organ.

In these examinations we also feel through the anterior and posterior parts of the fornix of the vagina. This will disclose certain unusual conditions, such as, anteriorly, infiltrations of the vesico-vaginal wall, of the connective tissue between the bladder and cervix uteri, even foreign bodies in the bladder, a transverse loop of intestine in the vesico-uterine fossa, etc.; posteriorly, various affections such as exudations, hemorrhages, tumors, etc.

As a general thing, rectal exploration furnishes better information concerning the uterine appendages, the structure of the broad ligaments, sacro-uterine ligaments and ovaries. It is only when the ovaries are situated in the anterior part of the pelvis—and they may even be located quite near the horizontal ramus of the pubis—that vaginal exploration gives better results. Such a position of the ovaries may generally be expected when the body of the uterus is situated more anteriorly, *i.e.*, in a condition of anteflexion or anteversion, but there are exceptions to this rule. The finger inserted in the vagina passes laterally from the border of the uterus, while the palpating fingers push the contents of the pelvis from behind and above downwards and forwards. The contents of the antero-lateral part of the pelvis are thus brought between the fingers and thickenings which may be present, or the normal bands in the broad ligament are easily felt. Even the ovarian ligament can often be distinctly followed to the ovary. Above the cervix we often feel the tense,' shortened and thickened part of the broad ligament, or the retracted connective tissue between the separated folds of the ligament, by means of which this part of the uterus is drawn towards the wall of the pelvis. If the vagina is distensible we can generally reach with ease the normally situated ovary (a little behind the median frontal plane of the pelvis, near the linea terminalis), when the abdominal walls are pushed downwards in this direction. When the ovary is situated more posteriorly, as in retroversions and retroflexions, it is easily found if it is at the same time lower .in the pelvis. It is then felt at the lateral border of the retroverted organ or nearer to the wall of the pelvis, in the neighborhood of the sciatic foramen. In some cases the inserted finger will suffice, its tip being turned towards the wall of the pelvis, and the parts pressed against the latter. We can not infrequently roll the tip of the finger over the ovary and thus determine its structure. The ovary is felt with the greatest difficulty when it is situated very high and posteriorly, on the median side of the sacro-iliac artery and above the entrance to the pelvis. Very strong counter-pressure must then be exercised, but rectal exploration is preferable under such circumstances.

The right ovary is generally situated farther back than the left, probably as a result of the corresponding torsion of the axis of the entire genital tract.

In examining the lateral parts of the pelvis the hands are changed; the right side is explored with the right hand, the left side with the left hand.

If a tumor is situated in the pelvis, or if it is situated, in the main, in the abdomen but projects into the pelvis, or at least can be reached from this cavity, the chief purpose is to ascertain its place of origin, or to exclude one or the other place of origin. We must then endeavor to palpate separately and on all sides the uterus, broad ligaments, ovaries, bony walls of the pelvis, etc. In this way we either detect the connection directly, or prove that there is no connection between the tumor and pelvic viscera.

The execution of this method turns out very differently, according to the individual case, so that only a few general rules can be given. If we have felt a tumor, or what has been regarded as such, and have determined, to a certain extent, its position, surface, consistence and shape, we must endeavor to define all its boundaries and to isolate it as much as possible. The tips of the fingers must then be inserted between the uterus and wall of the pelvis on the one hand, and the tumor on the other hand. The hand which is placed on the abdomen must also endeavor to pass between these parts and the tumor. After the tumor has been defined as thoroughly as possible, we must palpate the contours of the uterus, find the ovaries, and follow the pelvic walls on all sides. In this manner the connections of the tumor will be readily discovered.

But certain errors are especially liable to arise, if the apposition of the tumor with organs of the pelvis is so close that the appearance of a real connection is produced. The parts are, to a certain extent, wedged in alongside of one another in the pelvis, and the finger is unable to enter between them. In such cases changes of position are often very serviceable, especially the assumption of partial or complete abdominal positions, in which attempts at movement are made if necessary, *i. e.* the tumor or an organ, such as the uterus, is moved about. It is also very serviceable, under such circumstances, to attempt to displace the uterus still further, especially to draw it downwards. A forceps is applied to one lip of the cervix and the organ is drawn downwards or to one or the other side. In large growths, which fill the abdominal cavity entirely or partly, the tumor is sometimes wedged very firmly in the entrance to the pelvis, so that the tips of the fingers, which are entering from without, meet with an obstruction. The tumor should then, according to Schultze's plan,[1] be drawn upwards towards the thorax by an assistant, after he has previously pushed the abdominal walls down over the tumor as much as possible. In our experience this latter manœuvre, unfortunately, can only be done with great difficulty to a sufficient extent. The subsequent raising of the tumor necessarily increases the tension of the abdominal walls, through which alone the tumor can be palpated. We can generally succeed better by simply pressing the tips of the fingers between the tumor and uterus, and thus endeavoring to determine the existence or non-existence of a connection between the two, especially if the uterus has been pulled downwards with a pair of forceps. If this proves unsuccessful we must confine ourselves mainly to vaginal or rectal exploration, and it may then prove advantageous if, following Schultze's recommendation, the tumor is alternately raised and depressed by the assistant, in order that the tension and relaxation of its connections may make them more accessible to the exploring finger. In these difficult cases Freund advises that the patient should be examined with the head and trunk bent downwards, *i.e.* while standing, to a certain extent, on her head. If traction with the forceps is made at the same time, upon the portio vaginalis, any connection between the tumor and uterus will be made tense and more readily detected.

COMBINED EXPLORATION.—PALPATION OF THE ABDOMEN WITH EXPLORATION THROUGH THE RECTUM OR THE RECTUM AND VAGINA.

In some cases vaginal touch is impossible or inadvisable, as in stenoses, atresiæ or virgin conditions. We must then resort to rectal touch.

Even in other cases combined rectal exploration often offers such decided advantages that it should never be omitted in doubtful cases, whether it is to control vaginal exploration or because the latter appears from the start to be insufficient.

The thin yielding wall of the rectum permits us to palpate accurately the posterior wall of the uterus, its lateral borders, the entire outline of the fundus, the sacro-uterine and broad ligaments, the ovaries and walls of the pelvis, to a degree which is impossible through the firm, unyielding wall of the vagina. The tubes may often be recognized as strands, even when normal. At all events the slightest enlargements of the tubes can be detected. In addition it may be of interest to obtain an accurate knowledge of the condition of the intestines.

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[1] Zur Diagnose grosser Ovarialtumoren. Centralbl. f. Gynaek. 1876, No. 6.

The following is the technique: it is generally sufficient to introduce only a single finger; more than two fingers are rarely necessary. The finger is slowly passed through the anus, attention being paid to the sensitiveness and resistance of the sphincter, and then enters a more or less extensive, flabby walled sac, which is either empty or filled with fæces. Through this the cervix is felt above and anteriorly as a firm and relatively very large body, which is often mistaken by the beginner as the body of the uterus, or some pathological enlargement. Very accurate information can be obtained if the thumb is introduced into the vagina and applied to the portio vaginalis. Another source of information is afforded by the sacro-uterine ligaments, which converge on both sides as curved, elastic strands, from the thickness of a raven's quill to that of a pencil, towards the isthmus where they unite, generally as a sort of sharp or rounded comb. Pathological conditions, abnormal shortness of one or the other strand, great tension, rigidity, tenderness or thickening of these ends are readily recognized. The finger may now remain below these ligaments, in the space below the third sphincter. This is not advisable, however, since the finger is not directly behind the ligaments. The conditions will only be recognized clearly and without risk of error, if we pass above the folds of the third sphincter. This is occasionally difficult. The opening between the lower and upper portion of the rectum is often narrow, and may be situated more to the right or left, often far posteriorly. The anterior wall of the rectum sinks towards the ampulla, so that the lumen, which is thereby narrowed, can only be found close to the sacrum. Sometimes the posterior or rather the entire wall sinks towards the ampulla (somewhat like the first stage of an intussusception), and the lumen must then be sought at the tips (directed downwards) of this depression. If a column of the fæces is present it is only necessary to follow it; in many cases the way is shown by particles of fæces. The easiest method is to inject about ½ litre of water into the rectal ampulla. This distends it and the opening is then readily found along the smooth internal surface.

After we have thus entered the upper part of the rectum, the folds of the third sphincter and the sacro-uterine ligaments are pushed down by a slight claw-shaped curvature of the finger, after which it gains free play to the right and left in the wider portion of the gut. Moderate counter-pressure from the abdominal wall generally suffices to bring the posterior wall of the uterus and even all the contours of the organ in contact with the finger, and enables us to reach the boundaries of the fundus. Even if the uterus is ante-flexed or anteverted, it may be made accessible by the external hand, after the displacement is rectified. If, perchance, this cannot be done, moderate traction with the forceps upon the portio vaginalis will suffice. In favorable cases, if the fundus is pressed forwards and downwards by the inserted finger, the entire uterus may be brought between the latter and the thumb, which has been placed in the anterior part of the fornix of the vagina.

Next to the uterus, the appendages and ligaments are the object of our examination. Under normal conditions the sacro-uterine ligaments, the folds of the third sphincter of the anus, and the broad ligament are so yielding that the finger can be pushed very far forward. Passing up to the linea terminalis we may reach the bifurcation of the iliac artery, feel the pulsation of the external iliac and by pushing forward all the tissues, can reach the vicinity of the horizontal ramus of the pubis. If the external hand exercises counter-pressure, we can feel the folds in the broad ligament, composed of the tubes and ovarian ligaments and the ovary, and can determine the size, shape, mobility, and connection of the latter organ.

The appendages may be yielding to a certain extent, although considerable anatomical changes are present, such as circumscribed parametritis, small cysts, small fibromata at the lateral border of the uterus, callosities arising from old, retracted inflammatory products of slight extent. An ovary or pyosalpinx may be adherent to the lateral, posterior portion of the uterus, while other parts of the ligament are still distensible. Or an enlarged ovary or hydropyosalpinx may be situated in the posterior pelvic cavity, often quite to one side near the linea terminalis and in front of the sacro-iliac articulation, while the median portion of the broad ligament is but little changed and is distensible to a certain extent.

More extensive rigidity of the lateral ligaments of the uterus offers a greater or less resistance to the forward movement of the finger. According to the situation of the affection, the obstruction may affect the lower or higher parts, and one or both sides. Thus, the sacro-uterine ligaments may be found entirely unyielding, and, occasionally indistinguishable, inasmuch as a rigid wall ascends from their level to that of the entrance to the pelvis. This wall may be narrow, so that the border of the uterus is near the lateral wall of the pelvis, but it is sometimes wider. The finger must sometimes make a certain excursion forward in order to reach this wall; sometimes it comes immediately in contact with it, so that the wall of the rectum itself appears to have coalesced with it, as happens in extensive adhesion of the posterior layer of the broad ligament to the peritoneal covering of the posterior wall of the pelvis. This rigid wall contains a circumscribed structure of varying size, either immovable or still slightly movable, and which may be situated lower or higher, near the border of the uterus or more to one side. This is the enlarged or compressed, often irregularly shaped ovary, which is surrounded by masses of exudation. The finger may occasionally be placed upon and above the upper edge of the rigid ligament, and the firm large nodule is found situated on this upper edge or it is fixed on one side very near the linea terminalis, even more posteriorly at the sacro-iliac articulation or linea arcuata. We will rarely make a mistake in looking for the ovary, even under such complicated conditions, since often only a *single* thickening or circumscribed swelling can be found. In addition certain data are afforded by the character of the enlargement, its nodular shape, containing small spherical segments and retracted grooves. The consistence of the enlargement must also be taken into consideration.

The rigidity of the ligaments often affects only a few parts. The lower part of the sacro-uterine ligaments, next to the border of the uterus, and the upper portion of the broad ligament to a varying extent, may be unyielding, firm and thickened, and occasionally studded with hard, small, even pointed nodules. If the affection is bi-lateral, the rectum may be narrowed and grasped, as if in a vise. Further upwards the ligaments become yielding. The opposite condition may also obtain, the lower part being distensible and soft, the upper part firmer and less movable. The degree of rigidity and retraction may vary very considerably, from rigidity of the entire wall to a condition in which partial resistance is offered by a few firm strands, which are occasionally stretched like violin strings.

It is impossible to mention in detail all the different modifications which are produced by chronic inflammatory conditions of the pelvic cellular tissue and peritoneum, and to describe the various appearances when these are still further complicated by displacements of the uterus and tumors. But we must here call attention to the importance of such conditions as regards operative interference, ovariotomy, castration and hysterotomy.

Very little can here be added to what has been said under the head of combined vaginal touch, with regard to tumors proper, which are situated in the pelvis itself, or, being situated in the abdomen, project into the pelvis, or can at least be reached from the latter. As a general thing, rectal touch furnishes better information than vaginal exploration. Small tumors of the broad ligaments, whether sub-serous or not, small ovarian tumors, the various forms of hydropyosalpinx, elongated club-shaped or rosary-shaped swellings, etc., can be felt more readily through the rectum. If the tumor is situated on the ligament upon a broad base we should endeavor to pass between it and the uterus or pelvic wall, in order to see how much of the ligament is still left. Even in large tumors the isolation of the uterus can be better effected, and one or both ovaries can be felt more easily by means of rectal touch. Occasionally, however, vaginal exploration possesses the advantage, for example, when the tumor, as is especially apt to happen in sub-serous development, pushes the uterus forward and elevates it, so that it is situated above the horizontal ramus of the pubis. Finally, rectal exploration permits palpation of the bony walls of the pelvis, the anterior surface of the sacrum, the promontory and even the last lumbar vertebræ, the region of the sacro-iliac articulation, and the lateral parts quite far forwards. In order to complete the examination it should never be entirely omitted.

After careful trial we have entirely abandoned Simon's rectal exploration with the whole hand. It is not entirely devoid of danger, although this is not great if caution is exercised, and careful attention be paid to each individual case. The chief objection is that, as a general thing, even less is attained by it than by the method described above, in which only one or two fingers are employed.

The importance of combined rectal exploration is by no means sufficiently recognized. The condition of the sacro-uterine ligaments can never be accurately determined without it and without passing through the third sphincter of the anus. The course of these ligaments in a curve from the isthmus backwards, outwards and upwards, makes it impossible to trace them from the vagina. If the fornix is distensible, we arrive between the median portions and no further.

The broad ligaments with the organs contained in them (uterus, ovaries, tubes) can only be properly examined when they are fixed by one finger from the front, by the other from behind. This can be done through the vagina if the uterus is entirely movable, the ligaments relaxed, or if the uterus is displaced anteriorly and fixed. In both cases the hand upon the abdomen may reach the posterior surface, while the finger in the vagina palpates all the parts. But in the former case we have to deal with entirely normal organs or with conditions of relaxation. The diagnosis then is always easy, and we are very little concerned with such conditions. Anterior displacements with fixation are rare.

Very frequent and important, on the other hand, are the thickenings and retractions of the ligaments, the bands in the posterior pelvic cavity, which keep the uterus in a more or less retroverted or vertical position, sometimes with coincident anteflexion, and often cause fixation of the ovaries and tubes. In such cases rectal exploration alone will furnish full information. The hand which rests upon the abdominal walls can not move the uterus and ligaments so far forward, that it can penetrate deeply behind them. Simultaneous palpation, in the manner described above, is therefore impossible. But this can be effected very easily if the external hand passes behind the symphysis upon the anterior surface of the uterus and ligaments, while the finger which is introduced into the rectum very easily reaches high up to the posterior surface of these parts.

When the ligaments are rigid and unyielding high up, it is very evident that it is impossible, by means of vaginal-abdominal exploration, to come to any conclusion concerning the condition of the ligaments and uterus and the parts situated in the posterior pelvic cavity. But the upper part of the ligament is very often freer and possesses so much distensibility, that we can manage to push forwards the uterus, which is generally fixed in retroversion, and perhaps to determine the condition of the ovaries and tubes, which are in a condition of posterior fixation. The experienced physician will recognize, to a certain extent, the true condition of things from the immobility of the cervix and the decided lateral position of the fundus, which is moved forwards. The less experienced one will arrive at entirely erroneous conclusions.

Many are satisfied with an incomplete diagnosis, but this is followed by imperfect or rather by wrong treatment. Even in recent works we meet with opinions on this question which no longer correspond with the standpoint of modern gynecology. Many erroneous views, such as those on the subjects of retroversion and anteflexion, the treatment of the latter by intra-uterine applications, which is practised frequently even at the present time, on the significance of so-called chronic oophoritis, salpingitis and so-called chronic metritis, would soon be removed by a more careful examination.

A gynecologist who does not consider it necessary to examine the condition of all the uterine appendages, by all the aids of the modern methods of exploration, resembles a physician who, when consulted by a patient concerning a thoracic affection, fails to examine a portion of the chest, because he assumes that no change is to be found there.

Combined Exploration with Employment of the Bladder and Urethra.

This method almost always requires, as a preliminary, the artificial dilatation of the urethra, which is hardly possible without the use of an anæsthetic. The cases in which sufficient dilatation has been previously effected, as, for example, by coitus in atresia of the vagina, are rare.

The dilatation can often be performed by means of the finger. The edge of the external orifice of the urethra is slightly incised in various places with the scissors, or as Simon has proposed, ¼ cm. superiorly, ½ cm. inferiorly, and the tip of the little finger is then gradually bored in. The middle of the canal rarely offers an obstruction; the internal orifice, which may be very tense, often does. But the obstacle can gradually be overcome by gentle, gradual progression, the external hand pressing down, at the same time, upon the bladder. After the little finger has entered, the introduction of the index finger is generally easy. If the little finger meets with considerable obstruction, as is especially apt to occur in the first part of the urethra, and in which event the entire urethra is simply pushed backward instead of being entered, instrumental dilation must be employed. This may be done by a simple pair of forceps, whose branches are inserted about 2 or 3 cm. into the urethra and then separated. Ellinger's dilator may also be employed. But the dilatation is probably effected in the best way by the solid dilators recommended by

Hegar for dilatation of the cervical canal, or by Simon's urethral specula,—small, hard rubber tubes, whose lumen diminishes toward the tip, and which possess a knob that is firmly applied to the edge of the upper opening. These specula come in seven sizes, with diameters varying from ¾-2 cm., so that the dilatation can be gradually performed. The use of the largest sizes is not entirely free from danger, and permanent, but often only temporary incontinence has been observed. The base of even a small index finger has a circumference of 6-6.5 cm., and a diameter of 2-2.1 cm., measurements which equal or even exceed those of the largest speculum. Perhaps a very gradual dilatation will prevent the bad result referred to. Noeggerath warns against forcing a sharp ring at the neck of the bladder. If this is not present the dilatation may be carried to ¾ inch.

It is evident then, that we are not secure against permanent incontinence if the index finger is introduced into the bladder for purposes of exploration, and physicians whose index finger is more than 6 cm. in circumference expose the patient to a not inconsiderable danger in this respect. This method of examination should, therefore, be employed in those cases alone in which all other means of making a correct diagnosis have been employed without avail, and yet very much depends upon an accurate diagnosis.

Great caution must also be exercised with regard to severe injury, and the conveyance of infectious material. The mucous membrane of the bladder is very sensitive, and exhibits a tendency to purulent, ichorous or gangrenous inflammations. After the exploration, therefore, the bladder should be washed out carefully with a solution of carbolic acid, chlorine water, etc. Complete evacuation of the urine must be subsequently secured. For example, a tumor may divide the bladder into two divisions. From the lower one the urine is constantly dribbling in drops, while in the upper one the urine, which is mixed with blood, air, etc., as the result of the exploration, stagnates, decomposes and may produce a violent cystitis, as happened once in my Clinic.

Urethral dilatation is also employed for operative purposes, such as the removal of tumors, calculi, and foreign bodies from the bladder. The introduction of the finger into the bladder may also be useful or necessary in purely gynecological operations, such as amputation of the cervix, removal and scraping of cancer of the vagina, suture of vesico-vaginal fistula, opening of hæmatometra through the bladder. In the first mentioned operations it serves to control the instruments employed in the vagina.

The objects of the exploration are diseases of the bladder itself, such as foreign bodies, calculi, tumors, defects of the vesico-vaginal wall in atresia vaginæ, fistulous openings in the bladder. According to the necessities of each case, the abdominal walls, vagina and rectum will also be utilized in the examination. The extent of inflammatory infiltrations or malignant degenerations of the vesico-vaginal wall, para-vaginal tissue, the cellular tissue between the bladder and cervix uteri, the lateral cellular tissue spaces around the latter, can be readily determined by combined genital canal-bladder exploration.

Finally, enlargements and infiltrations in the vesico-uterine fossa, tumors which start from or are situated in the anterior uterine wall, tumors in the antero-lateral part of the pelvis, may also be the objects of exploration. At the same time the examination is made through the bladder, abdominal walls, bladder-vagina, or through the rectum. Even temporary dilatation of the cervix by means of sponge-tents and examination through the uterine cavity and bladder may be necessary in rare cases.

Exploration through the bladder and urethra is most indispensable in ascertaining the conditions present in atresia or stenosis of the vagina, in rudimentary conditions or absence of this organ, with or without errors of development in the uterus. We then examine through the bladder and rectum, or, with the aid of an assistant, through the abdominal walls, bladder and rectum.

INSTRUMENTAL EXPLORATION.

Exploration of the Bladder and Urethra.—Catheterization.

Manual examination of the bladder after artificial dilatation of the urethra has been discussed in the previous section.

For certain purposes examination with the catheter is sufficient.

A metallic or elastic female catheter is employed. A male catheter is necessary in rare cases of displacement of the bladder. As a substitute an elastic, somewhat long female catheter may be bent in the desired curve. The instrument is introduced after exposure and careful cleansing of the external orifice of the urethra, in order that secretion and dirt should not be conveyed into the bladder. It is first passed straight backwards and the handle is then depressed. The manner of introduction is modified in displacement of the bladder, when the latter has been recognized. If difficulties arise, the catheter is followed by the finger, and information is obtained at the same time concerning hardenings, the thickness of the urethral and vesico-vaginal wall, defects, etc. The coiling up of an elastic catheter will also be recognized. In passing the instrument through the urethra, attention should be paid to the sensitiveness and condition of the mucous membrane (blood), stenoses, or hard bands. In cases of fistula the tip of the catheter can generally penetrate the opening in the urethral or vesico-vaginal wall. The capacity of the bladder, the irritability of its muscular coat (contraction upon the catheter), the presence of tumors or calculi, can be determined with more or less certainty with the catheter.

In order to determine the capacity of the bladder and certain defects in the urinary organs (urethro-vaginal fistulæ, small vesico-vaginal fistulæ which are accessible with difficulty) it may be necessary to fill the organ with water or colored fluids. The following very simple method is used for this purpose, for washing out the bladder, and for the introduction of medicated fluids. A catheter is connected with a rubber tube, 50 cm. long, into which is inserted a glass funnel. If the bladder is full, the catheter is introduced while the tube and funnel are held low, a little below the level of the urethral orifice. The contents of the bladder then flow into the tube and funnel, where they may be examined. It may then be allowed to overflow and run out by depressing the funnel still further. If the bladder is empty, the funnel should be filled with the desired fluid before the introduction of the catheter, and as soon as the fluid begins to flow through the eye of the catheter, the tube is compressed by the fingers above its junction with the catheter. Air bubbles, which have adhered to the inner surface of the tube, will then rise through the funnel. The catheter is then introduced into the bladder, the tube being still compressed at its junction with the catheter. The fluid is now allowed to enter the bladder. On gradually lifting the funnel we can fill the bladder at any desired pressure or with any amount of fluid. It is generally advisable to employ a pressure which merely allows the fluid to enter the bladder. This can always be determined by merely looking into the funnel and noting the rapidity with which the fluid escapes. When the funnel is strongly depressed, the fluid in the bladder will flow back. This may be done, fresh fluid again introduced, or medicated fluids may be injected in the most gentle manner and without causing any mechanical irritation.

Complicated methods of examination of the bladder and urethra are not very successful. The employment of the endoscope has given us but little satisfaction, although we introduced thick canulæ through the previously dilated urethra. Winckel recommends Ruthenberg's apparatus, in which the bladder is distended with air.

If the presence of polypi or excrescences in the urethra is suspected we may introduce long forceps and attempt to grasp the little tumors. In this way we removed a polypus as large as a hazel nut, which was situated in the region of the internal orifice of the urethra and had produced violent hemorrhages.

In all examinations of the bladder, but especially in simple catheterizations, we must advise, after numerous sad experiences, the greatest care against the introduction of decomposed products and air. There does not appear to be any better nutrient fluid for noxious germs than urine mixed with blood serum, etc. The danger is increased still further if there is an obstruction to the spontaneous discharge of the fluid contained in the bladder. The catheter is used to relieve ischuria, but the latter condition still continues. Now, if the instrument has introduced air or some decomposing substance, or if a small hemorrhage (to which the condition of the mucous membrane under such conditions predisposes) has occurred as the result of a slight traumatism, a nidus of decomposition is created. The requisite time for decomposition is also allowed, inasmuch as the patient can not discharge the noxious mass, despite frequent violent straining. After the formation of diverticula in the bladder, such as are produced for example by a tumor, a portion of the contents is evacuated spontaneously or by means of the catheter, the other portion stagnates.

Whenever possible, catheterization should be avoided during child-bed or after-operations. This may often be done if the evacuation of urine is not delayed too long after delivery or surgical operations, and if the trunk, whenever possible, is raised a little and a warm sponge is pressed upon the genitals. If it becomes necessary to use the catheter it must be thoroughly disinfected. An elastic catheter should only be employed when new. If it is used repeatedly in the same patient, it should be washed out with a disinfecting fluid immediately after application, and this must be repeated prior to the next application. Kuestner calls attention to the great difficulty of thoroughly cleaning the ordinary catheter. The blind extremity, from the eye to the tip, is apt to be the site of accumulation of decomposed substances which are removed with difficulty. He recommends simple straight glass tubes, which are cut off obliquely at the end first introduced; the edges of the opening are blunted.

In making the application the external orifice must be completely exposed to the eye. This is occasionally quite difficult. The buttocks should be elevated by placing a pillow beneath them, in order that the introitus may be somewhat raised from the bed. The labia are separated with the fingers of one hand. With the other hand the vicinity of the external urethral meatus is cleaned with absorbent cotton which has been dipped in a disinfecting fluid. Not until this has been done is the instrument introduced. Positions such as the breech-dorsal, abdominal, lateral, and latero-abdominal, in which the intra-abdominal and therefore intra-vesical pressure falls considerably, must be avoided in catheterization, and special attention must be paid to other conditions, in which the pressure in the bladder is less than that of the atmosphere.

If such precautions are demanded under ordinary conditions, special attention must be paid to them when the bladder is already diseased, when there are inflammations in surrounding parts, ulcers in the introitus and vagina, when purulent, ichorous, or diphtheritic fluids escape from the genitals, from a wound in the abdominal walls, or when they flow across the urethral meatus.

Exploration of the Vagina.—Speculum Examination.

In multiparæ, in individuals with a wide vulvar fissure, and in rupture of the perineum, the lower part of the vagina is visible to the eye after drawing apart the introitus and pushing back the posterior commissure by means of the finger. This is facilitated by the use of vaginal retractors (Fig. 21), spatula-shaped instruments with which the wall, opposite or adjacent to the one to be examined, is drawn to the outside. In prolapsus of the uterus or vaginal walls these manipulations often suffice for examination of the deeper parts, or this can be done upon drawing the uterus downwards by means of a forceps inserted into one lip of the cervix. The vaginal walls are easily drawn down and inspected by the aid of forceps or elongated hooks, provided with single or double claws. The anterior vaginal wall may also be unfolded by means of a catheter introduced into the bladder, the posterior wall by the finger introduced into the rectum.

These explorations are made in the lithotomy or breech-dorsal position; the anterior vaginal wall is more accessible in the latter position.

Specula are required in order to expose the deeper parts, and, if the entrance to the vagina is narrow, the parts adjacent to the latter.

In our examinations and operations we employ simple cylindrical and valvular specula with auxiliary apparatus.

Cylindrical specula are very convenient because they require no assistance. In many cases they afford a satisfactory view of the vagina. They are also admirably adapted for the performance of certain manipulations, such as washing out the vagina with medicated fluids, cauterization of the portio vaginalis, lower part of the cervical canal, etc.

Cylindrical specula (Fig. 12) are made of milk glass, ivory, wood, hard rubber, horn, silver-coated glass. Some are conical, but this is by no means useful, at least if the conicity is at all considerable. The majority possess a sort of trumpet-shaped dilatation at the outer extremity. The tip is either straight or cut obliquely. The majority of cylindrical specula which are found at the instrument-makers are serviceable. Several specula of different calibres are required. Milk glass specula give a very good light and are not affected by ordinary remedies. Ferguson's speculum is more fragile, and its strongly reflected light is not very available. Hard rubber specula are light, can not be broken, are easily carried about in nests, and take the place of wooden specula when it becomes necessary to use the actual cautery. But the light is often insufficient. Special care must be taken that the speculum is not too long (12 cm generally suffice), the funnel end not too wide, the edges well rounded and not cut too obliquely.

The instrument must be adapted to the width of the vagina. This is determined on making the vaginal touch and on passing the speculum into the introitus. The lithotomy or breech-dorsal position may be employed. Cylindrical specula may also be used in the lateral position. The labia are separated by the thumb and index finger, and the hairs brushed to one side. The other hand holds the outer end of the speculum in such a way that the thumb lies upon the rim of the funnel from below, while a more remote part of the instrument lies between the index and middle fingers. The tip of the oiled instrument is now introduced into the introitus in such a way as to press the posterior commissure strongly downwards. If pain or spasm of the sphincters is produced, the tip is held quietly for a time, though still pressing downwards. If too large a speculum has been selected it should be exchanged for a smaller one. In its further introduction (which is not facilitated by rotary movements) the pressure on the posterior vaginal wall should be continued

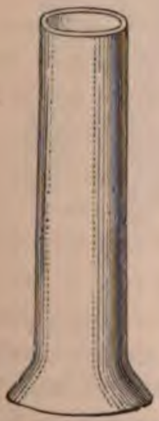

FIG. 12.

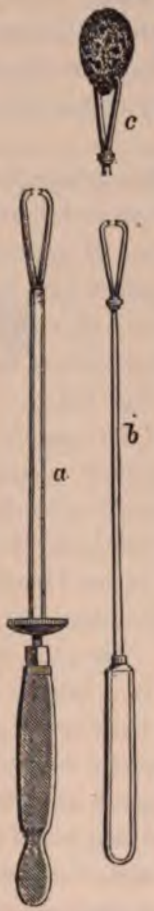

FIG. 13.

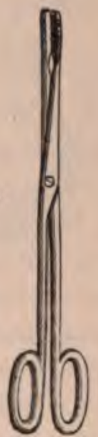

FIG. 14.

for a time, and the tip then raised by gradual depression of the handle. As a general thing the portio vaginalis will spontaneously enter the lumen of the speculum. If it is deflected considerably to one side, as has been recognized by the previous touch, the tip of the instrument is directed towards the corresponding side. The breech-dorsal position is often very serviceable when the portio vaginalis is situated high up and posteriorly, and also in retroversion, in which the handle must be depressed at once, or, at least, very early in order to bring the portio vaginalis into the lumen.

Folds of the mucous membrane sometimes drop in front of the cervix, but can be removed by raising and lowering the handle or by making rotary and lateral movements. If this does not prove successful the fold can be pushed back with a pair of long forceps, and the rim of the speculum pushed beyond it. The os uteri and adjacent parts may be cleaned with a small sponge or wad of cotton, fastened to a sponge holder (Fig. 13 a b c) or long forceps (Fig. 14).

During the introduction of the speculum attention should be paid to the color, turgescence, and general condition of the vaginal mucous membrane. As a general thing we thus obtain a good idea of the shape, size and color of the portio vaginalis and os uteri. On pushing in deeper, after the portio vaginalis is in the lumen, the edges of the os are rolled out, artificial ectropium is produced, and a view is thus obtained of the lumen of the cervical canal. The condition of the cervical mucous membrane, its color, secretion, etc., may be ascertained. It should not be forgotten, however, that on pushing the speculum in deeply the fornix of the vagina becomes firmly applied to the supra-vaginal part of the cervix above the insertion of the vagina, and that the portio vaginalis therefore appears to be longer than it really is. Nor should the mucous membrane, when in a condition of artificial ectropium, be regarded as an ulcer.

The cylindrical speculum is very convenient for the practitioner because no assistants are needed, and the requisite position may be assumed by the most unintelligent patient. It will not do for finer exminations of the middle and upper part of the vagina. The valvular specula are also preferable in considerable changes of the portio vaginalis, such as swellings, ulcerations, etc.

Cusco's bivalve speculum is also very well adapted for ordinary examinations. The two blades correspond to the anterior and posterior walls of the vagina. The screw works in such a way that the blades are most widely separated at the upper part of the vagina, so that the instrument is retained spontaneously. As a matter of course it is introduced while closed (Fig. 15).

Valvular specula were perfected by Sims, although the principle had been recognized earlier. Simon has modified the American speculum and has added certain auxiliary apparatus. But his mode of examination is entirely different from that of Sims and requires special consideration. Sims's speculum (Fig. 16) consists of two metallic blades of different sizes, which are narrowed at the tip in the shape of a duck's bill. They are at right angles to a curved metallic plate which connects them and serves as a handle. Two of these specula of different sizes are sufficient for almost all examinations. In occasional cases a blade which is larger than those found commonly in the shops will prove useful. Shorter blades are also serviceable for certain purposes. Braun has made similar specula of hard rubber, but these are preferable only when the actual cautery is employed.

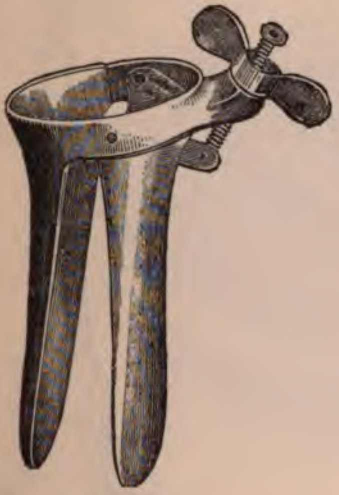

FIG. 15.

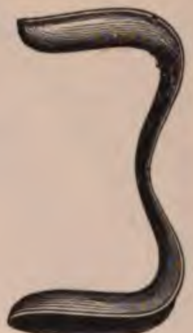

FIG. 16.

Sims also employs a fine long hook (Fig. 17) and a depressor, the latter being a metallic staff with a wooden handle, and a round fenestrated metallic disk at the tip. This depressor is used to push down the anterior vaginal wall, as soon as the latter forces itself into the way. Instead of the hook, which is apt to tear out, we generally employ a pair of forceps (Fig. 18). B. Schultze's forceps is also very serviceable. The tip of one blade presents a small, oblong quadrangular plate, the other possesses a double hook (Fig. 19).

With two fingers of one hand the physician lifts the posterior part of the introitus (in the knee-elbow position), then inserts the tip of the blade and pushes it in further in an almost horizontal direction. When it is introduced about half way, the speculum is drawn upwards slightly, in order to push up the almost vertical perineum. The vagina then distends with air, and permits sufficient inspection to enable us to determine the extent to which the speculum must still be introduced. The tip is generally vertical to the portio vaginalis or passes slightly beyond it posteriorly. When the exposure has thus been effected, the speculum is given into the hands of an assistant. The anterior vaginal wall runs back almost horizontally from the introitus, or it falls somewhat backwards and is concave superiorly. The portio vaginalis is then slightly raised.

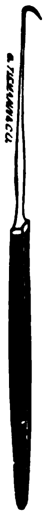

FIG. 17.

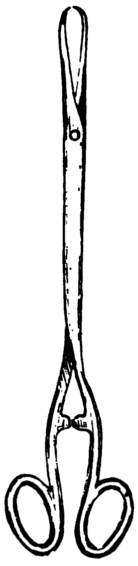

FIG. 18.

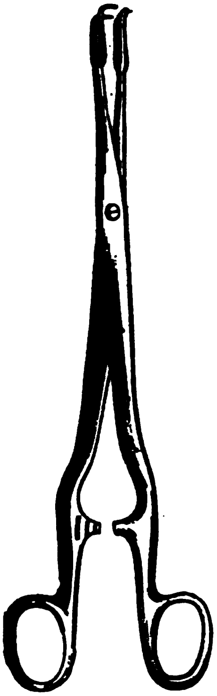

FIG. 19.

The distance between the concave surface of the speculum and the anterior wall of the vagina is very considerable, and may even amount to 5 or 6 cm. The position of the portio vaginalis in the pelvis is very much changed. It is more remote from the floor of the pelvis, at or near the plane of entrance, so that the body of the uterus is situated in the abdominal cavity.

In this position a very good view is obtained of the posterior part of the vault of the vagina, especially when the vagina and abdominal muscles are relaxed, so that the anterior vaginal wall and uterus sink more towards the abdominal cavity. As a general thing, however, exposure of the inner portions of the sexual organs in the abdominal position offers no special advantages and is rarely necessary. Furthermore, the position is very annoying to the patient if it must be retained for any length of time.

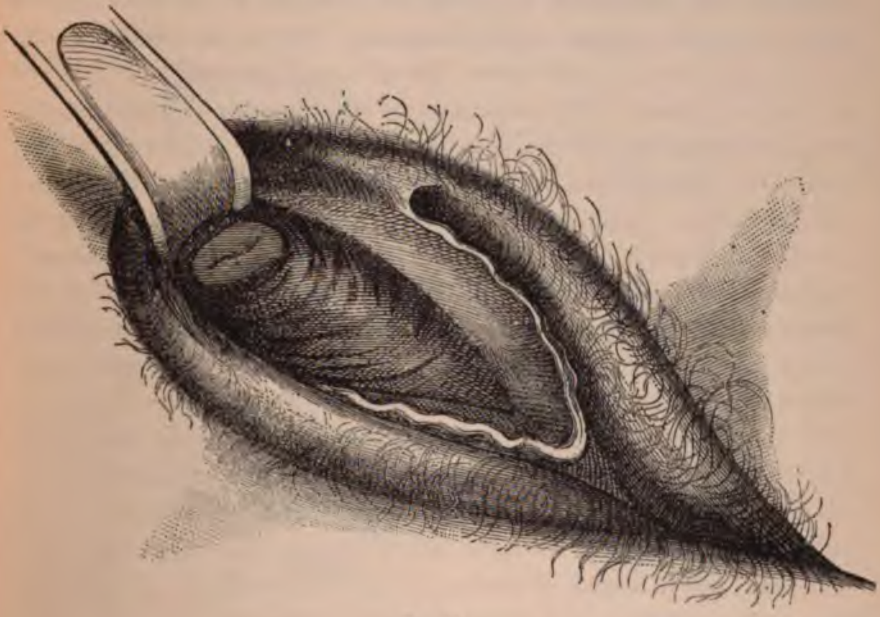

FIG. 20.

In the latero-abdominal position the speculum is introduced in the following manner (Fig. 20): After the patient has assumed the position described, page 21, the assistant, who stands at her back, draws up the upper buttock. The physician grasps the handle of the instrument and places its tip in the introitus. If we notice the connection of the sacrum and coccyx externally, and the blade is pushed in this direction, it can be pushed behind the portio vaginalis, even without introducing the index finger of the other hand. Moreover, unless the fore-arm is twisted, the index finger can only reach the portio vaginalis with the dorsal surface, with which little can be felt. We always examine in the manner mentioned and usually find the portio vaginalis free, as soon as, after the introduction of the speculum, traction is exercised in a direction parallel to the handle of the instrument, *i. e.* when the perineum and posterior vaginal wall are pushed outwards in this direction. The novice pushes the tip of the blade too far in an upward direction, and thus arrives in front of the portio vaginalis. Two circumstances interfere with its exposure, *viz.* deep respiratory movements or involuntary straining on the part of the patient, and marked swelling and narrowness of the vagina. The former can be relieved by giving the patient proper directions, by resting after the introduction of the speculum, before the perineum and posterior vaginal wall are pushed outward. If this is unsuccessful and also in the second contingency, the anterior vaginal wall is pushed gently downwards with a pair of forceps or a depressor. In order to bring the portio vaginalis nearer to the vulva the edge of the blade is placed immediately behind the posterior lip of the cervix and the latter is pushed forward by a lever-like movement of the instrument. If this proves insufficient, the anterior lip is seized with a hook or forceps, and drawn down. With patience and gentleness the parts may be exposed even in the most difficult cases, and in virgins, if the hymen is at all yielding. A somewhat long blade about 2 cm. in width is suitable for examination of the vagina in virgins.

Simon's method of exposing the portio vaginalis and fornix of the vagina in the breech-dorsal position is entirely different. Simon's instrument consists of four blades, each of which may be joined at a right angle to a firm handle by means of a hinge joint. In addition there are four metallic plates of different calibre and a similar handle (Fig. 21). Simon also employs vagina holders or lateral levers (Fig. 22), long metal plates bent at a right angle. As the perineum and posterior vaginal wall are directed downwards at a sharp angle, the blade is passed downwards in a similar direction, and the perineum is then pushed directly downwards by vigorous depression of that portion of the blade which is next to the handle. The anterior vaginal wall, which also runs sharply from above downwards, and is also displaced outwards by the intra-abdominal pressure, often projects, like a curtain, so that the portio vaginalis is seen only in part or not at all. But the portio vaginalis may sometimes be exposed by the speculum alone, if this is introduced for about three-fourths of its length, and if the operator not alone pushes that portion of the vagina which is nearest to the introitus, downwards but also draws it toward himself. By means of this traction the portio vaginalis is brought nearer to the entrance to the vagina. The metal plate is generally necessary to support the anterior wall of the vagina. A plate is introduced with the greatest possible gentleness as regards the structures situated anteriorly in the vulva. An assistant now grasps, below the patient's leg, the handle of the speculum with one or both hands, another grasps the handle of the plate from the side of the abdomen, the hand being supported upon the symphysis (Fig. 23). Both must work together harmoniously in accordance with the directions of the operator. If one or the other exercises too great traction the portio vaginalis will be drawn too much towards his side. Or one or the other pushes his instrument too far into the vagina or not far enough. The field of vision is thus apt to be displaced. The beginner often makes the mistake of introducing the instrument, from the start, too far into the vagina.

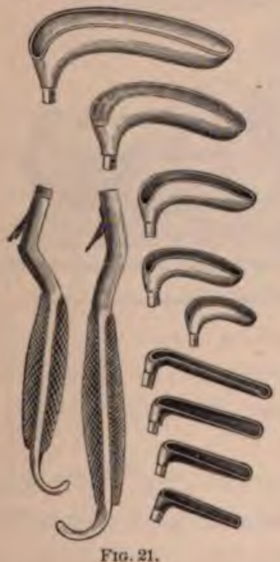

FIG. 21.

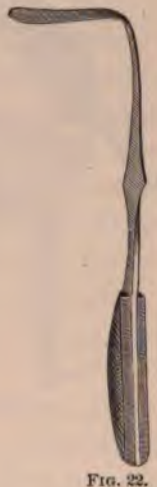

FIG. 22.

Complete exposure may require the use of lateral levers, in order to push out the lateral walls of the vagina if they press into the field of vision. They are applied to the lateral walls of the vagina, grasped by assistants on the right or left sides, and drawn outwards more or less vigorously. If the operator is to have his hands free, such complete exposure necessitates four assistants, one for the speculum, a second for the plate and a leg, a third for a lateral lever and the other leg, a fourth for the other lateral lever. The latter may attend to other duties with the free hand.

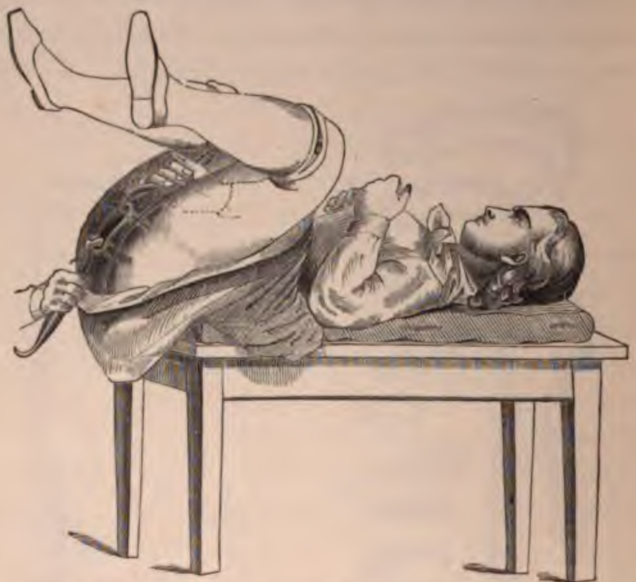

FIG. 23.

But even this may prove insufficient for many finer examinations. One or the other lip of the cervix must be seized with a pair of forceps or hook, and drawn downwards or to one side. In like manner certain parts of the vagina may be seized, stretched, the folds effaced and ridges drawn to one side. We often employ the speculum with or without the depressor for the anterior vaginal wall and the double pronged hook (Fig. 24) in order to lay bare circumscribed parts of the vagina, its fornix, or the cervix. The speculum and depressor must then be inserted to various depths, or the speculum is introduced with the lateral lever or with both, according as the part to be examined is situated higher or lower, or upon the anterior, posterior or lateral wall of the vagina. The conditions may vary to such an extent that very little can be said in a general way. The selection of the individual instruments and their size, the choice of the parts to which they are applied, the direction and force of the traction, are factors which can only be decided in each individual case. Practice and experience must come to our assistance.

As a matter of course the depressor and hook or forceps may be employed both in the breech-dorsal and in the latero-abdominal position. The latter is generally preferable, although the breech-dorsal position is better adapted for certain cases. The Sims position requires fewer assistants. For example, one assistant may hold the speculum and the upper lateral lever (the lifting up of the buttock with the hand then becomes unnecessary), and the second assistant holds the lever for the other vaginal wall. If the right side of the vagina is to be exposed in difficult examinations, the patient is placed on the left side, and vice versa. Such a change is sometimes very serviceable in bloody operations. The blood flows from the side which is situated uppermost and thus permits an unobstructed view.

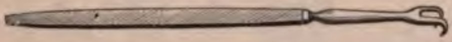

FIG. 24.

Bozeman has described, for operations on urinary fistula, a special method for exposure of the anterior vaginal wall, the anterior part of the vault of the vagina, the antero-lateral portions of the fornix and the portio vaginalis. He uses the knee-elbow position and places the patient in a specially constructed apparatus, which is put on a suitable firm, four-cornered table. This apparatus is shown with sufficient clearness in the adjoining illustration (Fig. 25) Into the vagina is inserted a bivalve speculum, whose two blades, (Fig. 26 *a a*) separate the lateral walls of the vagina, and, if necessary, stretch them laterally. This is done by means of the screw *b*. A third blade *c* supports the posterior vaginal wall. It is shoved in over the projections, *dd*, on the lateral blades and should be sufficiently firm to maintain its position without requiring the aid of an assistant.

We have employed this method a good deal and have arrived at the following conclusions with regard to it. The position itself is not injurious to the patient and anæsthetics may be conveniently administered in it. The terrifying part of the latter procedure may be obviated by giving the anæsthetic before the patient is strapped upon the table.

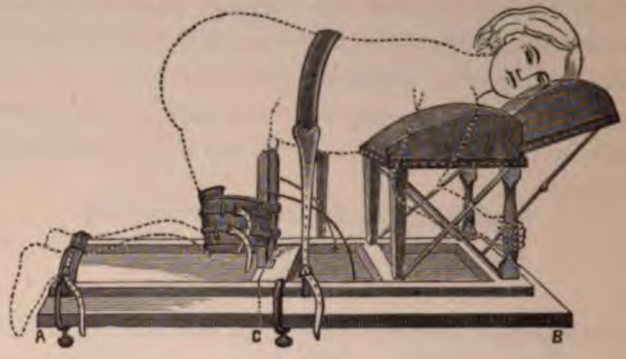

FIG. 25.

The exposure of the parts is usually effected very well, but the lateral blades of the speculum should not be separated too widely. The blade for the posterior vaginal wall is often applied with difficulty. It is said that the inventor often dispenses with this blade and replaces it by suitable spatulæ of various shapes and sizes, which require a special assistant. One disadvantage is owing to the fact that the field of operation is re-

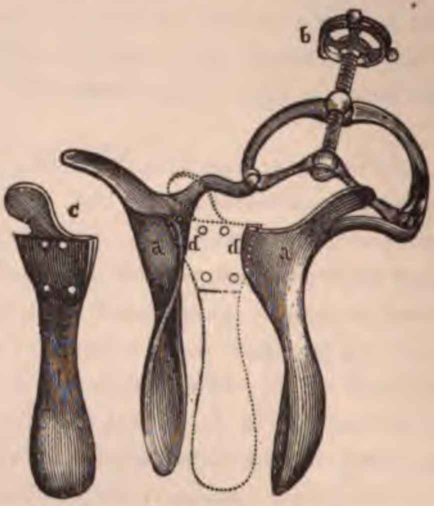

FIG. 26.

moved farther away, and that we must forego, to a greater or less extent, the advantage of displacing the field of operation by bringing it nearer to the introitus. The uterus sinks downwards and the anterior vaginal wall is elongated.

The fistula, or part to be operated on, being stretched on both sides at the same time, can be drawn forward with difficulty and only to a slight extent by means of hooks. A second disadvantage consists in the fact that the space left for the introduction of instruments is considerably diminished by the lateral blades of the specula, the light is apt to be hidden, and long-handled instruments alone can be employed. Furthermore, very few modifications may be made, while this can be readily done in other methods, for example, by discarding a lateral spatula or replacing it by a single or double hook, by introducing a small duck-bill blade upon the posterior vaginal wall instead of the larger one, by introducing to a greater or less depth the blade which is destined for the posterior vaginal wall. One advantage of this method consists in the diminished number of assistants required, chiefly owing to the fact that the patient is fastened in position. This advantage is counterbalanced by the fact that, during the performance of the operation, no suitable modifications may be made, or that these, at least, render other assistants necessary. It has also been shown that the blade, which is applied to the posterior vaginal wall, often fails of its purpose and must be replaced by a spatula which requires an assistant.

Neugebauer has devised a speculum which, like Bozeman's, is applied in the knee-elbow position and is self-retaining. The long handle rests on the loins or still higher upon the dorsal vertebræ. As a general thing we have found this more serviceable than Bozeman's instrument. The plate for raising the posterior vaginal wall is more easily applied (Fig. 27).

We have already had frequent opportunity of discussing traction of the portio vaginalis and individual parts of the vagina by means of hooks and forceps. In descent or beginning prolapse, or in conditions of mere relaxation of the uterine ligaments and vagina, such manipulations very often suffice for complete exposure of parts which are otherwise accessible with difficulty. If these favorable conditions are not present these manipulations, even when employed to a limited extent, will aid inspection through the speculum to a remarkable extent. Even when favorable conditions were absent, very extensive use was formerly made of these auxiliary measures, at least of drawing down the uterus (artificial prolapse). The cervix was pulled down by means of forceps or a ligature drawn through its lips. As a general thing this is not to be recommended either for exploratory or operative purposes. The means now at our disposal render forcible displacement unnecessary.

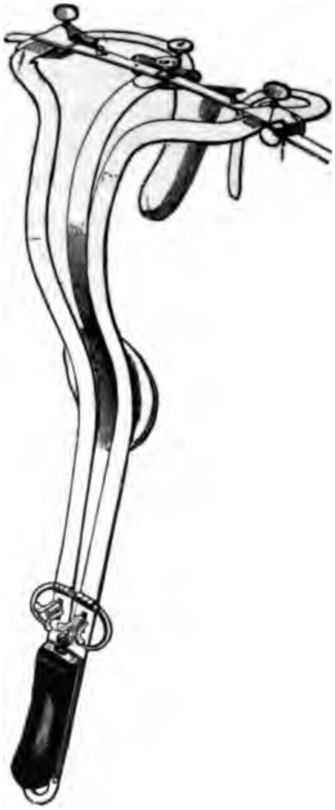

FIG. 27.

EXAMINATION OF THE UTERUS.—THE UTERINE SOUND.

The lowermost part of the cervical canal alone is visible to the eye. This is often seen on mere introduction of a speculum, either because a natural ectropium is present or it is produced artificially by the stretching or pushing back of the vaginal walls. By means of two hooks the lips can be separated and a view of the cervical canal is thus gained. In other parts the uterine cavity is not visible, and endoscopic exploration has been followed by even less valuable results than in the case of the bladder. The examination of the uterine cavity is therefore affected by the sense of touch. On account of the narrowness of the canal we are enabled to feel it through the medium of sounds alone, and it is only in exceptional cases that the cervical canal, without previous preparations, will permit the passage of the finger. It may, however, be made permeable. We must consider, accordingly, the introduction of the uterine sound and artificial dilatation of the cervical canal with subsequent exploration with the finger. In certain cases the latter is followed by exploration with fine polypi forceps and the curette.

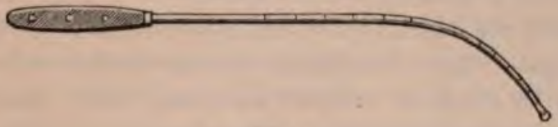

FIG. 28.

The use of the uterine sound, as a generally employed diagnostic aid, was introduced by Simpson. At present, when our diagnostic aids are more complete, the sound plays a much less important part than formerly. The uterus may be examined with any surgical sound of sufficient length, with an elastic catheter with or without the rod, with a flexible bougie. As a rule, we employ the so-called uterine sound (Figs. 28, 29) and a metallic rod with a button whose diameter varies from 3 to 5 mm. Various curves have been given to the instrument; sometimes one, sometimes the other is serviceable. At present we generally employ flexible sounds of some metallic alloy which may be bent as desired in each individual case. The sounds are graduated in size, and it is commonly preferable to employ those of a somewhat larger calibre. The same thing happens here as in catheterization of the male urethra. A thicker instrument is less apt to catch in the folds of the mucous membrane or to make a false passage. Not until cautious trials show that thicker in-

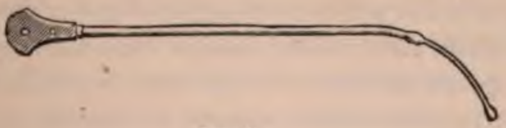

FIG. 29.

struments will not suffice (too forcible passage of a thick sound through the internal orifice is to be avoided) should we resort to thinner instruments. The sound is used not alone as a diagnostic but also as a therapeutic agent.

The instrument may furnish us with information concerning the capacity of the cervical canal, in many cases concerning its length, flexions and curvatures. It also instructs us concerning the length of the entire uterine cavity, its width, direction and position. A flaccid and movable uterus is readily displaced from its original position and shape during the introduction of the sound, so that our opinion of these relations is not entirely reliable. But even in these cases the direction and shape of the sound must be somewhat modified according to the condition of the uterus. If the organ is fixed and rigid the sound will only enter in its original shape. The instrument also informs us concerning the sensitiveness, roughness and projections on the inner surface, its hyperæmia and, in connection with other methods of examination, the thickness of its walls. The attempt has even been made to determine the mobility of the organ by means of the sound.

These objects are attained by various manipulations, whose utility can not be decided until they have been described.

The sound may be introduced either with or without the aid of the sense of sight. If the latter is excluded the patient is placed in the lithotomy or breech-dorsal position, or in a lateral position.[1] The index finger is placed on the posterior lip of the cervix close to the external orifice, and the sound is introduced along the finger. The external orifice is rarely so narrow that a thicker sound is unable to pass. If it has been held firmly against the orifice for some time, it usually enters suddenly.

The sound may thus relieve stenoses or adhesions of this part. As a rule the instrument meets with no other obstruction until it reaches the internal os. In rare cases obstruction is offered by swollen folds of the arbor vitæ, Nabothian follicles, or small tumors. The instrument may serve to recognize these conditions. The mode of passage through the internal orifice depends partly on the calibre of this orifice, partly on the direction of the canal. This should be determined, as far as possible, by the previous examination of the position of the uterus, and the further direction of the sound is modified accordingly. In anteversion of the uterus, the handle of the instrument is pushed strongly towards the perineum, in retroversion it is raised, in latero-version it is moved towards the opposite side. If such movements prove insufficient, further aid is afforded by giving to the sound a curve which corresponds to the abnormal position or shape of the uterus. In many cases from the start we give to the sound such a shape that the necessity of changing the direction of the handle is diminished.

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[1] The sound cannot be used properly in the ordinary dorsal position in bed. The buttocks should at least be raised by means of a firm pillow.

If the proper direction is followed an obstruction can only result from unusual narrowness of the internal orifice, or, in rare cases, from the presence of a tumor. Stenoses of the internal os may be produced by temporary spasm. This is soon relieved if the tip of the sound is quietly pressed against the os for a little while. Mechanical stenoses of moderate grade may also be relieved in the same way. But if the narrowing is more marked, we must use sounds with smaller tips or even surgical sounds. As a matter of course this must be done with extreme caution, since, despite every care, we may be mistaken with regard to the direction of the canal, or the sound may have caught in a furrow between the folds of the arbor vitæ. Torsion of the isthmus is also observed in some cases. Inasmuch as the sound meets with a certain degree of obstruction at the internal os, even under ordinary conditions, this may be utilized in measuring the length of the cervical canal.

In Sims's method of introducing the sound (exposure of the portio vaginalis with the speculum), certain obstacles are overcome more readily. After the exposure the anterior lip of the cervix is grasped with a hook or forceps, draw down, and the sound then pushed in. The traction generally, though not in all cases, diminishes the curvature of the canal. But if, for example, the fundus is adherent anteriorly, the anterior flexion will be increased by the traction. In such cases the portio vaginalis must be drawn backwards. But, as a general thing, this method of introduction is easier and less distressing to the patient. Care must be taken that the anterior edge of the speculum is not placed at a sharp angle behind the portio vaginalis, and thus exert pressure on the cervical canal. Hence the speculum should not be introduced too far nor should we make lateral movements, which will bring the edge further forwards.

After entering the uterine cavity, which is recognized by the increased facility of movement, and the greater amount of free play, the fundus is easily reached. The button may be drawn to and fro along the internal wall of the uterus, in order to test its sensitiveness, smoothness or roughness. In order to convince ourselves of the mobility of the organ, the latter may be moved laterally or in thé antero-posterior direction by means of the sound.

To determine the thickness of the posterior wall, the finger is introduced into the rectum and the uterus pressed against the finger by raising the handle of the sound. To measure the thickness of the anterior wall the sound is pushed against the hand, which is applied to the abdominal walls, by moving its handle backwards. Tumors in the uterine walls (fibromata) may also be diagnosed and their thickness determined in this way. We cannot, however, recommend these manipulations very highly. If soft tumors are present, exfoliated shreds often adhere to the sound, and their examination with the microscope may make the diagnosis certain. In a large fibro-cystic tumor we readily penetrated to a distance of 14 cm. into the degenerated tissues.

Therapeutically, the sound is employed chiefly for the reposition of the retroverted or anteverted uterus. This may be done in two ways. In retroflexion the sound, which is introduced with its concavity directed posteriorly, is turned on its long axis, so that the concavity is directed anteriorly. The reverse is done in anteversion. Or the sound is introduced with the slightest possible curve, and in retroversions the handle is depressed as much as possible upon the perineum; in anteversions it is raised against the symphysis. The latter method is much gentler, inasmuch as the entire length of the instrument within the uterus is pushed against the inner surface of the organ, while in the former manipulation the tip of the sound chiefly comes in contact with the walls.[1] The sound has also been employed as a dilator of the stenosed cervix. It is introduced, allowed to remain for a time, and thicker sounds are gradually employed. Some have also used the instrument to irritate the uterus, produce contraction of the flaccid organ or an increased supply of blood, for example, in amenorrhœa and in defective development of the uterus.

If we review all the objects for which the uterine sound is employed, we will soon arrive at the conclusion that the majority of them can be secured by other and less injurious means, and that in many of these cases the sound is not even the most serviceable means. Bi-manual examination will almost always suffice for the differential diagnosis of small pelvic enlargements and uterine displacements. The same method will almost always give us sufficient information concerning large tumors whose mode of connection with the uterus we wish to determine, although in a few cases the introduction of the sound may be important in ascertaining the size and position of the uterus. The sound is insufficient for the diagnosis of tumors within the uterine cavity. As a general thing it merely furnishes us with data as to the manner in which the examination is to be continued. The reposition of the displaced organ can generally be effected in other, less injurious ways, by manipulations with the hands and the aid of a suitable position of the body. Even in developmental anomalies of the uterus, such as uterus bi-cornus, it will suffice to make a bi-manual examination through the rectum and abdominal wall if necessary, after drawing the portio vaginalis slightly downwards with the aid of forceps. Now, in view of the greater attendant dangers, can we recommend measurement of the thickness of the uterine walls by means of the sound?

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[1] Sims has devised a special jointed sound for reposition. We have tried this instrument but can find no advantage in its use.

This, together with the length of the organ, can be ascertained by combined examination. This will also serve for the diagnosis of adhesion and for testing the mobility, while the sound is neither necessary for these purposes nor is it devoid of danger. Adhesions of the uterus to the rectum and posterior pelvic wall are discovered with certainty by rectal examination. Retractions and rigidity of the broad ligament, which so often give rise to a straight position or to moderate retroversion of the uterus, cannot, indeed, be diagnosed with sufficient accuracy without a rectal examination.

To describe all the manipulations which enable us to dispense with the sound would carry us too far. They are all mentioned in the description of the various methods of examination. One condition, however, cannot be recognized without the sound. We refer to mechanical stenosis of the cervical canal, although this is much rarer than is generally believed. Furthermore, the sound may lead us into error in such cases, inasmuch as changes in the direction of the canal may give rise to the diagnosis of stenosis. In exceptional cases we may also be compelled to ascertain the size and position of the uterus by means of the sound, on account of specially unfavorable circumstances, such as the impossibility of making a thorough bi-manual examination.

When compared with former times the use of the sound is now confined within narrower limits. If carefully employed, its dangers, especially when its introduction is unattended with great difficulty, are not very great, and consist merely of a slight discharge of blood and moderate uterine colic. Active and long-continued endometritis, following the introduction of the sound, must be ascribed to the use of a dirty instrument. But in mild cases the use of the sound is generally superfluous, and when its introduction is attended with difficulty, even the most skilful gynecologist must exercise great caution.

A suspicion of pregnancy, inflammatory conditions of the uterus and its appendages must be regarded as absolute contra-indications. It is even best to avoid the introduction of the instrument if the parts are very sensitive.

The use of the sound has been very much restricted in modern gynecology, and the principle generally holds that the instrument is to be employed only when other methods of examination fail. We rarely employ it, and sometimes merely to furnish data for exploration in other ways. In tumors which were intimately connected with the uterus and which could not be distinguished from the latter by manual examination, we have obtained information concerning the position of the uterus, by means of the sound, and were then often enabled, after renewed bimanual exploration, to define the boundaries of the organ and determine its relation to the tumor.

Numerous cases have been recently reported in which the sound was introduced to an unusual distance without any special violence or resistance. The size of the previously palpated organ did not correspond to the length of that portion of the sound which was passed through the os uteri. This is explained in three ways. The sound is pushed into the peritoneal cavity through a so-called metro-peritoneal fistula, a previously formed, permanent fistulous canal in the substance of the uterus. This explanation has been applied to cases in which the sound was easily introduced for a long distance in an imperfectly involuted uterus, and its button could be felt immediately behind the abdominal walls. Valenta passed the sound in a woman who had had a difficult forceps delivery and then suffered from a polypus, as large as a fist, upon the posterior lip of the os uteri, 23 cm. above the posterior lip. The point of exit of the sound through the uterus was easily felt through the rectum. The polypus was removed and later the fistula was no longer demonstrable. Valenta assumes that the forceps delivery had resulted in necrosis and that a fistula had thus been formed. In the cases reported by Lawson Tait such a cause was wanting, and perforation of the uterine wall with the sound may be assumed with certainty. Bandel mentions several cases of communication of the genital canal with the abdominal cavity, developing after major operations, such as removal of the inverted uterus.

In the majority of cases the sound probably enters so deeply because the uterine wall is penetrated. In some instances the perforation evidently occurs very easily and without the employment of force. The predisposition is created by sub-involution of the uterus after child-bed, by so-called super-involution, and by changes of structure in malpositions, neoplasms or capital operations (ovariotomy). Perforation is favored by displacements and the consequent difficulty of following the direction of the canal with the sound (perforation of the anterior wall in posterior displacements). Fixation of the organ by inflammatory processes, which do not permit any accommodation with regard to the direction of the entering sound, is also a predisposing factor. The perforation has been demonstrated anatomically in a number of cases.

Finally, in the majority of cases in which the sound is introduced to an unusual depth, it enters the tubes. This has been proven in Bischoff's case. In a case of ovarian tumor Bischoff introduced the sound to the depth of 17 cm. After the death of the patient following ovariotomy the uterus was found uninjured. Its cavity was 9 cm. long, the walls very firm; the left tube was dilated, its uterine orifice funnel shaped, and, on account of version of the uterus towards the right side, was situated in such a position that it was necessarily entered by the sound.

This explanation is also very probable in certain other cases in which the sound suddenly entered to one side for an unusual distance, and its button could then be felt through the abdominal walls, at a considerable distance to the side of the umbilicus. Conditions which give rise to dilatation of the uterine cavity from stasis of menstrual blood and secretion (and which, therefore, may produce dilatation of the tubes) are mentioned not infrequently in these cases. The conditions referred to include anteflexion with stenosis of the cervical canal, and hæmatometra from adhesion of the cervix and vagina.

From his experiments and observations Biedert concludes that the characteristic features of tubal sounding are lateral deviation, palpation of the button of the sound through the abdominal walls at a considerable distance to the side of the umbilicus, the impossibility of turning the sound without the employment of force and without producing pain in such a way that the button can be felt near the median line. It is only after the sound has been introduced to a distance of 15 or 16 cm. that it could be felt near the median line. But this does not afford complete certainty, since the sound, after perforation, may pass between the layers of the broad ligaments, and similar conditions will then be observed.

BLOODLESS DILATATION OF THE CERVICAL CANAL, FOLLOWED BY EXPLORATION OF THE UTERINE CAVITY.

Bloodless dilatation is performed partly for diagnostic, partly for therapeutic purposes.

The dilatation renders it possible to enter the uterine cavity with the finger and to feel its inner surface. In some cases such marked dilatation is unnecesary. We may merely wish to introduce a narrow, polypi forceps or a small curette, with which instruments portions of the mucous membrane, proliferations, parts of a tumor, are removed for further examination. The cervical canal is rarely dilated as a preparation for combined examination through the abdominal walls and uterine cavity, when we desire to gain information concerning the thickness and consistence of the entire organ. This has been previously discussed.

The indication for diagnostic dilatation of the cervix is most frequently offered by hemorrhages, whose source can not be accurately determined without this preliminary. We often have grounds for suspecting a foreign body or new growth. The hemorrhage has continued for a long time. It began after delivery at full term, still more frequently after premature delivery, and remnants of the ovum are then found in not a few cases, or adenomata develop from parts of the decidua that have been left behind. The body of the uterus is very much enlarged, and the sound finds an obstruction which is otherwise inexplicable, and comes in contact with prominences and rough places. But there are many menorrhages and metrorrhagias, even after delivery, in which very marked changes of the mucous membrane are not present. The hemorrhage is produced by relaxation of the uterine walls, venous stasis, simple hyperæmia of the mucous membrane. In many cases there is slight diffuse hyperplasia of the membrane, which may be relieved by injections of tincture of iodine, astringents, etc. As a general thing, therefore, it is best to hold fast to the rule that the uterus should not be made permeable to the finger unless we possess definite reasons for believing that we will find a morbid process, whose recognition and treatment require dilatation. In other cases we should first use the ordinary remedies against hemorrhage; these are capable, at the same time, of relieving a certain series of pathological changes. If this proves unsuccessful, dilatation may be performed. These remarks also hold good concerning discharges of a catarrhal or other character.

The following are the therapeutic objects which we endeavor to attain by means of dilatation of the cervical canal. Relief of a stenosis which obstructs the escape of menstrual blood and uterine secretion or the entrance of semen. Dilatation has been recommended even when the stenosis is not the result of tissue changes in the cervix, but rather of changes of shape, curvature of the canal, flexions. Such an attempt is justifiable, especially when non-enlarging substances are employed, because the organ may be straightened, though often not permanently. Bloodless dilatation here forms a rival of dilatation by means of incision. As a general thing we prefer the latter when the lower part of the cervical canal, particularly the external orifice, is affected, and the former operation in affections of the higher parts and the internal orifice. Dilating measures have also been employed for therapeutic purposes in order to act upon the structural changes of the uterus. Compressed sponge has been chiefly used for this purpose. Schlesinger, who has recently advocated this measure very decidedly, lays stress upon the loosening and moisture of the tissues, and their actual drainage, which is sometimes manifested even in the form of profuse, serous secretion. Hypertrophic conditions, swellings of the mucous membrane, hemorrhages and blenorrhœa may be relieved in this way. The increased hyperæmia and succulence are followed by greater absorption and diminution in size. Small polypi may be necrosed by the compression exercised by the sponge. These effects are intensified by subsequent brushing of the surfaces with tincture of iodine and astringents, which then act more vigorously. Fraenkel has also used the compressed sponge in the imperfectly involuted, flabby uterus, in order to produce a tonic, stimulant effect.

Dilating measures are generally employed as preliminary to further therapeutic interference, to introduce instruments into the uterine cavity, or to facilitate the escape of fluids, secretions or crusts during intra-uterine applications.

When uterine injections are to be made or solid caustics applied, this may often be done without previous artificial dilatation, even if the cervical canal possesses only a moderate capacity. But as the application (to be shortly described) of solid, non-swelling dilators is extremely convenient and devoid of danger, it is well, even under such circumstances, to produce moderate dilatation, if it is probable that the escape of the injection fluid and the scurf exfoliated after cauterization will not be unattended with difficulty. This holds good particularly when very irritating fluids or strong caustics, such as nitric acid, are employed. In such cases it may also be advisable to introduce dilators for some time after the little operation, in order to prevent subsequent retraction and stenosis.

More marked proliferations of the mucous membrane, and polypoid new growths require the introduction of larger instruments, such as curettes and polypi forceps, so that on this account alone the cervix must be dilated to a greater extent. In addition the finger must often be introduced in order to guide the instrument.

The greatest degree of dilatation is rendered necessary when solid tumors, especially those of large size, are to be removed, or when we propose extirpation of intra-uterine fibroid polypi or intra-mural myomata, which project strongly towards the cavity of the uterus.

The contra-indications consist, in the main, of inflammatory processes in the uterine appendages. Even when processes of this kind have run their course, in retractions and callosities of the broad ligaments, adhesions of the ovaries, pseudo-membranous bands and threads, fixation of the uterus from previous perimetritis, etc., we must, at least, exercise caution, and still more in tubal affections, especially pyosalpinx.

The means employed to produce dilatation of the cervix consist, first, of tents which are made of substances that absorb fluid and thus increase considerably in circumference.

We also employ metallic dilators, whose blades are introduced closed into the cervix, and then are separated from one another by a special mechanism. Finally, we may use solid cylindrical or conical bougies, made of metal or hard rubber. Each of these is of unchanging calibre, and dilatation is effected by successively introducing thicker and thicker instruments.

The tents which are most employed are made of compressed sponge and laminaria. Gentian root and tupelo tents have also been used.

Compressed sponge tents (Fig. 30) are made by compressing, within metallic molds, thoroughly cleansed sponge which has been dipped in a solution of gum. They are generally well made, the surface is smooth, and they are usually disinfected with carbolic acid. It is well to dust them with iodoform before using. They are easily introduced in the latero-abdominal position, if the portio vaginalis is exposed with the aid of a Sims speculum and fixed by means of a hook or forceps (Fig. 31). In our opinion it is inadvisable to introduce them or any other form of dilator without previous exposure of the portio vaginalis, because the canal cannot be sufficiently cleaned otherwise, and noxious substances are readily introduced from the vagina into the cervical canal.

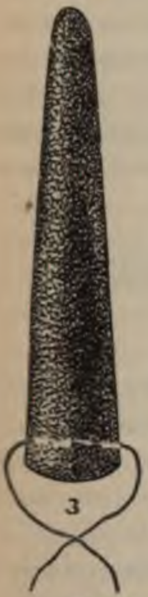

FIG. 30.

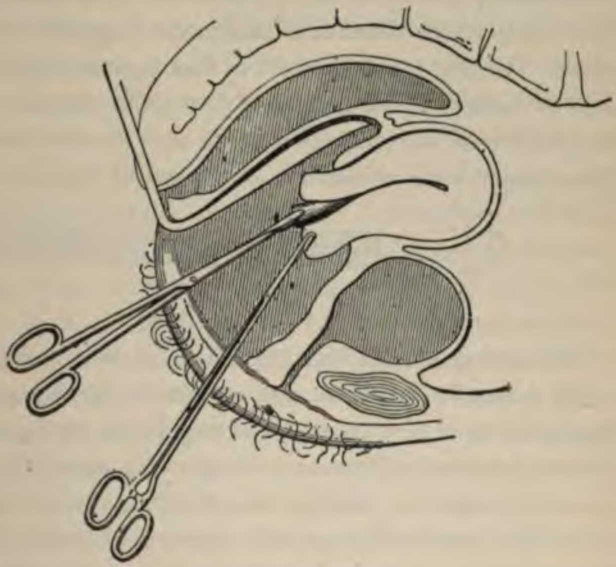

FIG. 31.

Compressed sponge possesses the disadvantage that it is with difficulty passed through the internal orifice. The tip is apt to bend. This can generally be avoided by first using very narrow and then increasingly thicker tents. It has also been recommended to introduce the first tents merely as far as the internal orifice; the subsequent ones then enter readily. But this procedure is too slow. A still greater disadvantage consists in the action of the sponge on the adjacent tissues. According to the careful experiments of Haussman, the surface of the tent is found to be covered, at the end of two hours, with epithelium, and the secretion which is discharged contains microscopic components of the sponge. Haussman noticed marked decomposition of the secretion at the end of 1½ hours. These bad effects are so much more worthy of consideration because very protracted and repeated use of the sponge tent is necessary in order to effect sufficient dilatation for diagnostic and therapeutic purposes. The removal of the tent is also inconvenient. Since it is apt to become wedged in the furrows of the arbor vitæ and to become brittle, the parts must be carefully exposed and the tent removed by means of traction and lever movements with a pair of forceps.

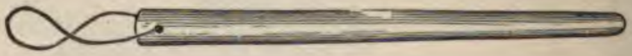

FIG. 32.

The laminaria tent (Fig. 32) is inserted in a similar manner. Before using it may be dipped for a short time in boiling water and then in a cold solution of carbolic acid, and may also be bent according to the direction of the canal. If we do not begin with too thick a tent, it is readily passed through the internal os. Schultze advises that it be removed at once, if its introduction causes a discharge of blood. The attempt should also be abandoned for a time if blood appears during the preliminary examination with the sound. According to Haussman the superficial elements of the cervix are less apt to be exfoliated, and the cervical epithelium appears much later upon laminaria than upon sponge tents. But decomposition may set in, especially if rough, brownish tents are employed. Spiegelberg states that fresh laminaria tents are apt to decompose into a brownish, foul-smelling jelly. Cohn was unable to determine whether this is also true of the prepared tents, but the water in which they were dipped possessed a biting taste, like that of lye, and the surface of the tent bit the tongue.

Well-made laminaria tents swell to twice their volume in 8 to 12 hours. As they are apt to slide out of the cervix, a tampon must be applied to the os uteri. The tent should measure 5 to 6 cm. in length. After its removal an annular constriction is often found at a point corresponding to the internal orifice. As a result of this the tent may be retained very firmly and may resist removal. The base of the tent is usually perforated and supplied with a thread. If the tent is softened, the thread may pull through on strong traction. It is better to fasten the thread firmly around an annular groove at the base. If traction on the thread meets with considerable resistance, it is generally preferable to remove the tent with a pair of forceps, after exposing the portio vaginalis. Even then we must exercise caution. It has happened to us that the tent, which was held back by the internal orifice, has broken off at the middle, the upper half remaining behind, the lower half being removed. All immediate attempts to remove the former proved unsuccessful, and this could not be done until some time afterwards. The patient suffered, in consequence, from a slight parametritis. In the majority of cases it is necessary, in order to be able to insert the finger, to introduce repeatedly tents of gradually increasing thickness or a number of thinner ones which are placed alongside of one another. This plan requires 18 to 36 hours for its completion. It is very important to wash out the uterus whenever the tents are removed. In many cases the uterus can be irrigated, even before the introduction of the first tent, by means of narrow canulæ.

We have had very little experience in the use of gentian and tupelo tents. Elischer and Landan extol their virtues and state that the swelling is more uniform than that of laminaria tents.

As a general thing these measures act very slowly and in an inconvenient manner. Compressed sponge is entirely uncertain. Laminaria will at least dilate the internal os uteri. But in order to be able to introduce the finger we almost always require the repeated application of successively larger tents so that the procedure occupies, on the average, 36 to 40 hours. Apart from the annoyance incident to this method it is evident that, despite the greatest care, infection cannot always be prevented, in view of the long duration of the application and the previously mentioned characteristics of the tents. For this reason the tent has been enclosed in a rubber tube, 20 to 25 cm. long, and 1 to 2 cm. wide, the tube being filled with water in order to distend it. It is better to follow the excellent recommendations of Schultze, who first applied the principles of antisepsis to this slight but important operation.

We do not attach much importance to one advantage ascribed to the tents, *viz.*, that they excite a sort of labor pains, by which the neck of the uterus is shortened, softened and dilated. In very many cases these favorable effects, *viz.*, shortening and softening, occur to a very slight degree or very slowly. On the other hand the pains are not infrequently extremely violent and may even necessitate the removal of the instrument. In the very numerous applications made by us, we have generally found that the dilatation was purely mechanical, and corresponded to the enlargement of the tent. Even then, the contraction of the sphincter muscle, particularly at the isthmus, was often very disturbing to the inserted finger. Moreover, the effect varies according to the condition of the uterus. If certain preliminaries to the spontaneous expulsion of the foreign formations have developed, if the cervix is short and the internal os somewhat dilated—as in individuals who had given birth to a child not a very long time before, or still more if birth or abortion had occurred a short time before—the results are often very rapid and complete. Dilatation is often extremely difficult in virgins, nulliparæ or multiparæ with abnormally elongated, hyperplastic cervix. In some cases it is not alone the cervix which must be dilated. The so-called pars intermedia, the part between the partes keritanæ and the neck, may be very resisting and narrow. The passage of the finger is occasionally very difficult or even impossible, despite repeated and protracted application of laminaria.

The second method of dilatation of the cervix by means of steel instruments, whose blades are introduced closed and are then separated, was first recommended by Busch for obstetrical purposes, *viz.*, for inducing premature labor. Ellinger was the first to recommend a two-bladed dilator for gynecological purposes. Then followed various modifications of the apparatus. Schultze devised one in which the dilatation takes place in a sagittal direction, but he merely employs it to complete a previous dilatation with laminaria. The required dilatation is obtained during the irrigation cure by occasional introduction of the dilating instrument. Sims describes a complicated dilator of this kind. Some recommend a simple pair of forceps.

We have never been satisfied with this method. The pressure is always unequal and affects only those parts against which the blades are applied. The spring of the blades, which can not be entirely avoided, is disturbing. The cleansing of the instrument is attended with difficulty.

Dilatation sufficient to permit introduction of the finger and palpation of the uterine cavity can hardly be effected in difficult cases.

The last method consists in the use of solid, bougie-like instruments of unchanging size. Thicker bougies are successively introduced. Peaslee used cylindrical, slightly conical steel sounds, the ends of which were prevented by an onion-shaped enlargement from passing too far into the uterus. Sounds of various sizes are screwed upon a long, universal handle. Hanks employs ovoid, hollow dilators, made of hard rubber and of ten sizes. Lawson Tait uses conical bougies (4 sizes), which may be fastened to the same handle. Fritsch has devised five steel sounds with buttons of various sizes, the diameter of the thickest being 1.5 mm., that of the thinnest 0.5 mm.

Of late years we have often employed these methods of dilatation and have found them very serviceable. The fact that they are not generally adopted is due, in great part, to the improper technique and the imperfection of the instruments. We should possess, at least for difficult cases, a large number of bougies, of which the one to be introduced should be very little larger than the one previously inserted. We have therefore devised solid, cylindrical hard-rubber bougies, with conical tips. They are 12 to 14 cm. long, exclusive of the flattened handle which is about 5 cm. long (Fig. 33). The diameter of the smallest bougie is 2 mm. The diameters of the others increase successively by 1 mm., so that the increment of the circumferences is about 3 mm. It is still better if the increment of the diameter is only ½ mm. At least the dilatation is thereby facilitated in difficult cases. A bougie, whose diameter is 16 to 17 mm., suffices for internal palpation of the uterus. A thick index finger with the first phalanx may then be introduced into the cavity of the uterus. Greater dilatation may be secured by means of larger bougies, and we have provided ourselves with some which possess a diameter of 26 mm. But those which exceed 16 to 17 mm. in diameter may only be used in exceptional circumstances, when considerable softening and dilatation of the cervix are already present, for example, in protrusion of a myoma through the cervix. Bougies of 5 to 10 mm. diameter will suffice for uterine injections, cauterization with nitrate of silver, nitric acid, application of the curette or small polypus forceps, for relief of cervical stenosis, or when it is proposed to dilate the canal only a little beyond the average.

The bougies are very easily cleaned and disinfected. After being used, they are brushed with soap, washed with a disinfecting fluid, and then kept in a solution of carbolic acid or corrosive sublimate. Before using them they are dipped into a 5 to 10 per cent. solution of carbolic acid. The vagina is irrigated with a disinfectant fluid, and the patient placed in a position suitable for exposure of the portio vaginalis. We prefer the latero-abdominal position and Sims's speculum. The anterior lip is well secured and then a bougie, whose thickness varies according to the width of the cervical canal, is introduced. According to the resistance experienced, progressively larger bougies are introduced more slowly or rapidly. Great force may not be employed. This may be avoided by keeping the inserted bougie in position for a longer time, as soon as considerable resistance is experienced. We are sometimes compelled to desist with one bougie, and to reintroduce the one just inserted. As a general thing we can succeed in producing sufficient dilatation to introduce the entire in-

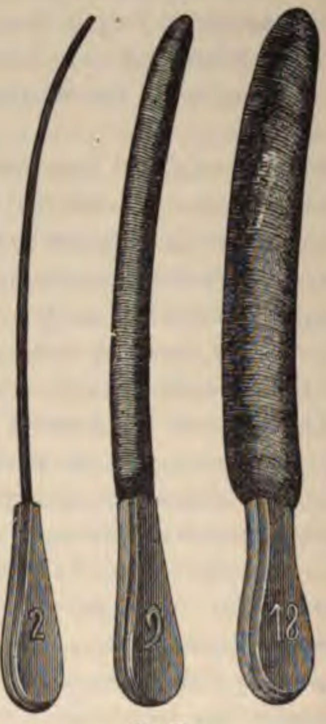

FIG. 33.

dex finger in 1 to 2 hours. But in certain cases it is advisable to devote a longer time to the operation. The injurious effects which have been observed are the results of hasty introduction.

The advantages of this method are evident. The dilatation, together with the subsequent operative procedure, requires very little time, and thus the method is very convenient, not alone to the physician but especially to the patient. Disinfection is performed very easily and thoroughly. The smooth, hard rubber has none of the disagreeable properties of the distensible tents. The shortness of the time required greatly diminishes the dangers of infection. Since the introduction of this method we have entirely discarded the use of tents. But we must again insist that force is to be avoided, and that, under no circumstances, is it justifiable to secure by force sufficient dilatation for the finger or larger instruments.

Exploration of the uterine cavity after sufficient dilatation of the canal is made in the following way. The index finger is passed through the canal, while the hand resting upon the abdominal walls pushes the fundus downwards. If the internal os contracts, the finger is pressed steadily against it, while the hand at the same time pushes steadily from the outside. In anterior displacements the external hand pushes between the symphysis and uterus and pushes the latter backward. In posterior displacements the position is first rectified by the ordinary manipulations. Under more difficult conditions the portio vaginalis is fixed with a pair of forceps.

A number of cases of serious accident, and even death after the introduction of tents, have been reported. They are due chiefly to circumscribed parametritis and perimetritis, but also to diffuse septic processes. Tetanus has also been observed.

Engelmann reported 13 fatal cases, following the use of sponge-tents, the majority of which occurred in the practice of skilled specialists. In many cases the peritonitis first appeared distinctly after the introduction of the third sponge-tent. He also mentioned a still larger number of non-fatal inflammations.

EXPLORATION AND EXPOSURE OF THE RECTUM.

The lower part of the anterior rectal wall can often be made accessible to the sense of sight, if the index finger, which has been introduced into the vagina, exerts strong pressure on the recto-vaginal septum above the posterior commissure, and a portion of the septum together with the anterior rectal wall is pushed into or even through the anus (Storer). Other parts must be exposed with a speculum. Simon first showed that the anus possesses an extraordinary degree of distensibility. Hence, the old cylindrical and many bladed specula are no longer employed. Sims's and Simon's specula, vaginal depressors and hooks are used as in examinations of the vagina. The administration of an anæsthetic is not necessary in simple examinations, but becomes necessary when protracted exposure is required for operative interference, when large specula are used or the anus is sensitive (fissures). Prior to the examination the rectum must be carefully cleaned by irrigation. The lateral position may be employed, but the breech-dorsal position is preferable. If the anus is not very yielding, a small speculum should first be employed. But as a general thing larger ones may be employed from the start if they seem to be required. The blade is gradually introduced by making gentle rotatory movements. As a general thing our object is to expose the anterior rectal wall. If the blade pushes the posterior wall of the rectum strongly downwards, the anterior wall is exposed opposite to the anal orifice. The very tense cutaneous rim of the anus anteriorly often causes considerable obstruction and prevents a view of those parts of the anterior wall which are immediately adjacent to the anus. This is sometimes obviated by the selection of a narrower blade, by which means the anus is not drawn so strongly towards the sides and the cutaneous rim is somewhat relaxed. We may also push, from the vagina, against the anterior wall of the rectum and bring it into view, pulling down the rim with a tenaculum. In case of necessity Simon advises that incisions ½ cm. deep be made on both sides of the principal cutaneous fold.

In exposing the lateral parts of the rectum, a vaginal depressor is most serviceable. According to Simon the posterior wall may be exposed by pushing away the anterior wall with a broad blade and stretching the lateral walls with vaginal depressors. For operative purposes the sphincter may be cut in the raphe posteriorly. This incision also divides the lower part of the posterior rectal wall, which is concave anteriorly. The canal is thus straightened and shortened to such an extent that the upper part, lying in the concavity of the sacrum, is rendered more readily accessible.

Distension of the rectum and higher parts of the gut with water or other fluids is mainly employed for therapeutic purposes, for the production of an evacuation from the bowels. Rectal injections are very serviceable in chronic peritonitis and parametritis. They are generally made, at least in the beginning, at the temperature of the blood. Later the temperature may be raised or lowered, if we desire to produce a greater stimulant effect. It is best to allow the temperature to be regulated by the feelings of the patient. In the beginning small amounts should be used, about ½ litre, and later we may increase to 1 to 1½ litre. The injection is performed without great pressure in the latero-abdominal or knee-elbow position. A pause should be made occasionally during the injection. The patient is directed to retain the fluid as long as possible, though she need not exert herself too much in the beginning, since better results are obtained after repeated applications. I never make more than one injection daily, but Chadwick recommends two to three applications daily. After they have been used for 2 or 3 weeks, there should be an interval of rest. In much rarer cases the injections are made for diagnostic purposes (communications between the rectum and the vagina, uterus or bladder). Even distension of the intestine with air has been recommended in order to differentiate hydronephrosis and ovarian tumor, but this plan is based on erroneous views. In gynecological examinations, in which we so often use the rectum at the present time, and in many operations (colpoperineoraphy, perineal plastic operations) the rectum must be irrigated merely for the sake of cleanliness.

Since we have learned to apply certain physiological truths in the doctrine of intra-abdominal pressure to the minor but very important procedures in question, no other apparatus except Hegar's funnel (Fig. 34) or an ordinary wound irrigator should be employed. We know how comparatively slight is the abdominal pressure, especially in quiet positions of the body, and how easy it is, when necessary, to diminish it still further by the assumption of the lateral or abdominal position. The pressure of a column of water of 20 to 40 cm. is almost always sufficient to permit the entrance of fluid into the rectum. If necessary, a longer tube may be employed. These two simple apparatus meet all the conditions required. At the same time they are the cheapest and most durable, and are entirely innocuous, a quality which can not be predicated of all other instruments.

The tube which is introduced may be provided with a rounded, olive, shaped tip, and we are convinced that this is not so apt to produce injury and excoriation as a thin tube with a sharper tip. These tubes may be made of tin, hard rubber or glass, and are then easily kept clean. If the patient is very sensitive, or the applications are to be made for a long time, a softer material is preferable. The rectal mucous membrane is very sensitive, and it seems to us that "enemata" ulcers may result not alone from a single, incautious application, but from the protracted use of enemata, despite the fact that no technical error has been made.

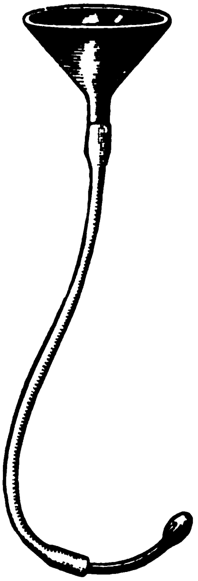

FIG. 34.

In my clinic the funnel is also employed to make injections of medicaments which are to be absorbed. The tube is inserted into the anus, and 60 to 120 gm. of the fluid poured into the funnel. As a rule it does not run off at once, on account of the air contained in the tube. This is removed by compressing the tube from below upwards.

CHAPTER II.

GYNECOLOGICAL OPERATIONS.

MINOR THERAPEUTICAL TECHNIQUE AND ELEMENTARY OPERATIONS.

VAGINAL INJECTIONS.—APPLICATIONS OF MEDICINAL SUBSTANCES TO THE VAGINA AND PORTIO VAGINALIS.

FLUIDS are applied to the parts in question by the aid of irrigators, the funnel apparatus, syphon apparatus and syringes, or by means of a speculum.

The selection of the injection apparatus requires our entire attention. We must be able to regulate the amount of pressure, and inasmuch as many patients make the injection themselves, their application should not be attended with the exercise of much force. Nor should they be inconvenient for the patient. In addition we must be able to prevent the entrance of air with the injection fluid, especially in cases of wounds, ulcers and patulous cervix.

The simple wound irrigator (Fig. 35) is an admirable apparatus for vaginal injections. The vessel is connected with a rubber tube of the requisite length, and this provided with a suitable tip of metal or glass, terminating in an olive with several lateral fenestræ. Kocks recommends a tube which splits, at the end, into two branches which again unite, so that it here presents the shape of a large eye of a needle, about 5 cm. long and 0.5 cm. at the widest part. The openings empty into the eye, so that if the tube, by chance, enters the cervix, the latter remains dilated and the fluid freely escapes. The pressure under which the fluid flows is regulated in the simplest way by holding the vessel higher or lower. The air is easily removed if some fluid is allowed to escape before introduction into the vagina, and care is taken that the tip is removed from the vagina before the fluid sinks to the level of the opening in the vessel.

Hegar's funnel apparatus is very cheap and simple, and is used in the same way as the irrigator, but the funnel can not be hung up. Hence the aid of a second person is often necessary. If simple washing of the vagina is alone intended, the patient can get along very well without the aid of a second person.

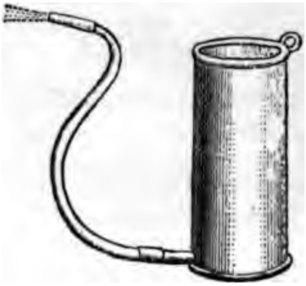

FIG. 35.

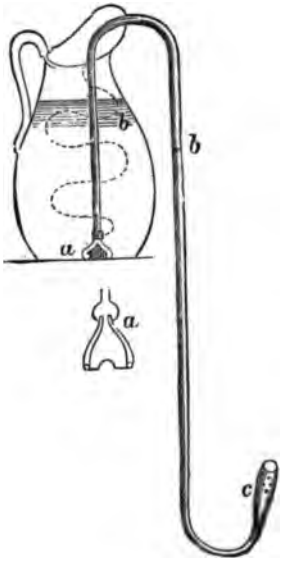

FIG. 36.

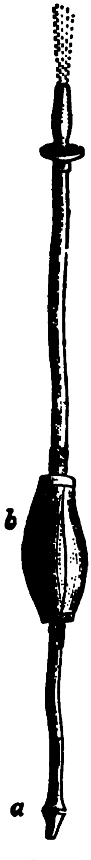

FIG. 37.

The syphon apparatus (Fig. 36) consists of a vessel upon the bottom of which rests a hollow leaden hemisphere (*a*). Similar pieces, made of any metal desired, are kept by the instrument makers, as they may also be employed for other douches. This is connected with a long tube (*b*) to which is fastened a tip (*c*). In order to make the instrument work, a part of the tube is placed in the vessel in a twisted shape (*b'*), so that it fills with fluid; the end is firmly compressed with the tips of the fingers; it is lifted from the vessel and then lowered beneath the level of the fluid. At first air and water escape, then the fluid alone.

A very convenient apparatus is the Davidson syringe (Fig. 37), consisting of a rubber bulb, tube and tip. The end (*a*) is dipped in water. By allowing the bulb to dilate and then compressing it, the fluid is sucked into the bulb and then propelled along. The fluid is apt to be mixed with air, and the apparatus easily gets out of order. The patients are inconvenienced by the pumping, unless this is done by an assistant.

Former apparatus of this kind are hardly worthy of mention. They are more apt to get out of order and more difficult to manipulate than an irrigator. The only advantage they possess is the suddenness of the impact of the fluid. But this can be dispensed with, and, if required, can readily be obtained from an irrigator. It is merely necessary to compress the tube temporarily and to let it go suddenly. So far as we know, disagreeable accidents have only been observed after the use of rubber syringes. But it is necessary to mention them, inasmuch as they may possibly result from the use of the irrigator. Sudden violent attacks of pain, chill, fainting spells, coldness of the extremities and vomiting have been observed after the use of the former apparatus. These symptoms either subsided or a peritonitis (sometimes of a very acute and fatal character) developed.

In many of these cases the origin of the symptoms remains unexplained. They have been attributed to increased sensibility of the patient, to the production of shock or the irritation of inflammatory foci in the neighborhood of the vagina and cervix uteri. The condition of affairs is occasionally clearer. Air entered a vaginal vein which had been eroded by carcinoma, or the fluid passed through the cervical canal (because the tip accidentally entered the os uteri) and passed through the uterus and tubes into the abdominal cavity. In order that the latter accident may occur, certain predisposing conditions, such as unusual width of the os uteri, cervical canal and tubes, must have been present. As a general thing such conditions are found only during a short period after delivery (either at full term or premature). But these accidents have also been observed at other times. Nervous symptoms of minor significance are not very rare in sensitive patients, even when the irrigator is used. One of my patients suffers from pain in the head and toothache after each irrigation.

The mode of application depends upon the object to be attained. It may be said in general that the position of the patient should not be uncomfortable, and that she should not be exposed to a wetting. It is only when the irrigation is for simple cleansing purposes that the patient, in a sitting position, may use a bed-pan or other suitable vesssel. When used for other purposes the patient should lie in a comfortable position, and use a bed-pan of metal or china. Since large amounts of fluid are employed in many cases for a long time, constant escape of the fluid must be secured. This is best done by placing in the bed-pan, near the bottom, a metallic tube which runs towards the edge of the bed. To this is fastened a tube which conveys the fluid into a vessel standing on the floor. Care must be taken that the tube is not compressed or bent. The metallic tube in the bed-pan should therefore, be tolerably long. The rubber tube should also be provided with a bulb, so that, upon lifting it above the level of the bottom of the bed-pan, it may be compressed and dilated, and a syphon action thus produced.

The injections are used most frequently for simple cleansing of the vagina, and their duration may then be limited to 1 to 2 minutes. Lukewarm water is used, mixed, if necessary, with a disinfecting fluid. Cleansing injections of the temperature of the blood may be safely made during menstruation, and they are even to be strongly recommended if the menses are attended with fluor or a foul smell. In other cases our object is to act, by means of astringent, mildly caustic remedies, upon the mucous membrane, as in vaginal catarrhs, erosions of the portio vaginalis. In such cases the remedy is added to the fluid and used in the same way as in simple cleansing injections. Neither the pressure nor the duration of the injections need be considerable.

If we desire to produce uterine contractions by irrigation of the vagina, we should select a fluid of high (up to 40° R.,) or low temperature, even ice water. The application must be brief and higher pressure is necessary.

In certain cases of wounds, deep ulcerations, gangrenous conditions, etc., the vagina is to be disinfected by long-continued, even permanent irrigations. The most difficult feature of this procedure is the position of the patients, who are apt to get up bed-sores on account of the wetting, which is avoided with difficulty. Special mattresses with an aperture have been recommended. We prefer, in general, to introduce a glass tube. The connecting rubber tube, into which a funnel is inserted, is drawn up towards the abdomen and fastened to an abdominal bandage. From time to time the nurse places under the patient a bed-pan with overflow tube, and makes an irrigation of longer or shorter duration, satisfying herself at the same time that the vaginal tube is still in position. The pressure need not be great and the temperature is that of the blood, unless otherwise demanded by special circumstances.

Protracted daily vaginal irrigations (one or more times a day) with water at the temperature of the body or higher (up to 40° R.), have been recently employed with great success, according to Emmet's recommendation, in various sexual diseases. In some cases a lower temperature (to 30° or even 20° R.) has been used. The theoretical explanation of their effects leaves much to be desired and it is difficult to base upon them any indications. Emmet himself attributes the effects to the production of an artificial anæmia of the tissues, which are said to grow pale or even white. In the first stages of inflammatory processes the water should be used at a temperature of 36 to 38° R., in protracted cases a temperature of 32 to 33°. Others claim that the first contraction of the vessels, resulting from the high temperature, is followed by relaxation and increased supply of blood. A temperature which approximates that of the blood acts, from the first, like a poultice. The effect is, therefore, essentially that of a slight inflammatory irritation, swelling and œdematous infiltration of the tissues, which is followed later by increased absorption. Finally, the effect has also been regarded as purely mechanical, in exudations as a sort of massage by the stream of water.

Irrigation is also said to exercise a general effect, by diminishing nervous excitement and inducing sleep. But while these effects are produced in some, in others the procedure produces the opposite effect.

Experience teaches that irrigations often furnish valuable results in imperfect involution of the uterus for some time after child-bed, and also in older connective tissue and muscular hypertrophies of the uterus, with or without notable endometritis. If menorrhagia or metrorrhagia is also present, we employ high temperatures, considerable pressure, and do not allow the douche to act too long (about 5 to 10 minutes). The irrigation may be performed twice a day. Several repetitions daily, but without great pressure and of short duration, are often very serviceable even in profuse hemorrhages during menstruation. Hot water injections are decidedly preferable to cold ones during menstruation. At other times better results are occasionally obtained from cooler fluids. Warm and hot irrigations are mainly employed in chronic parametritis, pelvic peritonitis and the sequelæ of these conditions. In these cases their duration is generally prolonged, 4 to 10 litres, for 15 to 30 minutes. The pressure is usually not very great (40 to 100 cm.). The temperature varies from 32 to 40° R. Two applications daily are also recommended.

As is true of all other remedies, whose physiological action is not thoroughly known, and whose effect varies very much according to the condition of the tissues and the individuality, the patient must be closely observed and the mode of application modified. The more stimulating the method the lower must be the pressure, and the nearer the temperature to that of the blood. But this may be merely predicated as a general rule. A very sensitive individual sometimes tolerates hotter or cooler irrigations. Considerable pain, and especially a rise of temperature, necessitate immediate discontinuance of treatment.

In the acute stage of pelvic inflammations irrigations are not employed, because the mere motion and the position on the bed-pan may be injurious to the patient. Nor do we know in such cases to what extent the tubes are affected. The encapsulation of a pyosalpinx or some other purulent focus might be very much interfered with.

Most authors recommend irrigations mainly in the later chronic stages of the disease, others adopt them as soon as the acute stage has subsided. But in the latter event great caution must always be exercised, since the careless use of douches has set up inflammatory processes even in very protracted affections.

Speculum-like instruments with double walls have also been employed to apply cold or heat to the sexual canal. Into the interviewing space passes a tube for the entrance and one for the escape of the fluid. Both are connected with rubber tubes and suitable vessels. Better still is a small capsule which is placed in the vault of the vagina. The lower part of the vagina is then not distended and is also less affected by the heat or cold, and the effect is restricted to the parts desired.

Gases may also be applied to the vagina and fornix. Chloroform and carbonic acid have been employed. A brass capsule (Fig. 38 *b*), which may be screwed on and contains the sponge wet with chloroform, is connected on one side with a rubber bulb (*a*), on the other side with a rubber tube terminating in a tip. Compression of the bulb forces the vapor into the vagina. It is said to produce at first a burning sensation, and later a local anæsthesia which lasts 4 to 6 hours.

Carbonic acid has been introduced into the vagina through a rubber tube connected with a flask for developing the gas.

Both methods have been very little used. Scanzoni observed a fatal termination in a woman during the 4th month of pregnancy, probably from the entrance of carbonic acid into the vessels through the dilated cervix.

The so-called bath speculum (Fig. 39), a hard, rubber, conical speculum, closed anteriorly and provided with numerous openings, is employed for protracted applications of fluids to the walls of the vagina and the fornix.

Apparatus made simply of thick wire rolled into a spiral shape and which separates the vaginal walls by their resiliency (Fig. 40) have also been used, but these are less to be recommended inasmuch as the wire is apt to become wedged in and to cause pain. The speculum is used during a full bath or sitz bath, and if the upper part of the vagina is to be irrigated, must be introduced under the fluid. The speculum is often used in sool baths. If the solution of salt is not too concentrated, the irritation is not apt to become too great. The mechanical dilatation may also act favorably in vaginismus and allied conditions.

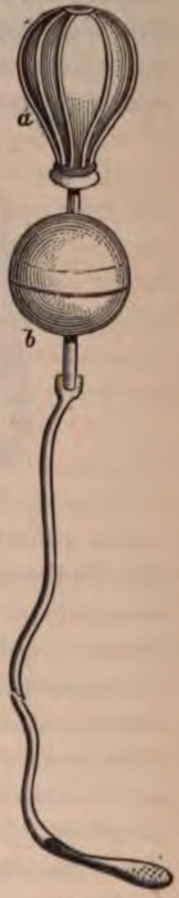

FIG. 38.

A very convenient method of applying slightly caustic or astringent solutions to the mucous membrane of the vagina or portio vaginalis is the irrigation of these parts by means of a cylindrical speculum, made of milk glass or hard rubber. The speculum is introduced in the usual way, the portio vaginalis exposed, and the solution poured in sufficient quantities to cover the portio vaginalis. It may also be introduced into the cervical canal by means of a brush. According to the object to be attained, the fluid is allowed to remain for a variable length of time. If the rim of the speculum is pressed firmly against the vault, the portio vaginalis and its immediate neighborhood alone will be touched by the solution. If its action upon other parts of the vagina is not desired, the fluid is allowed to escape by depressing the handle of the speculum and the remainder is dried with a sponge or cotton. If we intend to act upon the entire vagina or a large part, the speculum is gradually withdrawn, without removing the fluid, so that the latter comes in contact with the lower parts; by means of a brush we can assist its contact with the upper and lateral walls. In this way any part of the vagina may be brought in contact with the medicament.

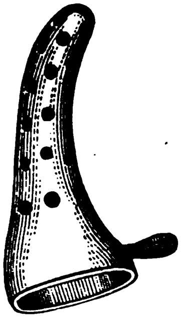

FIG. 39.

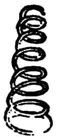

FIG. 40.

In applying solutions of alteratives or astringents in glycerine, a certain amount may be poured into the speculum, the latter withdrawn a little, so that the fluid passes into the posterior part of the vagina; a tampon of cotton or a sponge is then introduced, after which the speculum is removed. The tampon prevents the rapid escape of the solution, and absorbs the latter, so that it remains in contact with the vaginal walls for a longer time.

A similar plan is the introduction into the vaginal vault, by means of a speculum, of a cotton tampon or sponge, which has been previously dipped into the medicament. The bath of the portio vaginalis and vagina, as performed with the aid of a milk glass speculum in the manner described, was first recommended by K. Mayer. Thus, he properly ascribes good effects to such an application of raw wood vinegar in papillary ulcers of the os uteri. The vinegar is introduced in such quantities that it covers the entire ulcer and remains in contact with it (3 to 5 minutes) until a sort of white coating has formed. This is repeated in 4 to 5 days, whereupon profuse suppuration sets in. We now await the results, and, if necessary, repeat the procedure, perhaps after the next menstruation and not too early. In this way Mayer's plan has afforded us the most valuable services. Solutions of nitrate of silver may be used in the same way. Concerning the strength of the solution, as employed ordinarily in catarrhs of the cervix, catarrhal and follicular erosions, vaginal catarrhs, very little can be said in a general way, since so much depends upon the individual case. Stronger solutions (10 to 20 per cent) are usually preferable, because they may be applied at longer intervals. The scurf produced by the cauterizing fluid is allowed to exfoliate, and the irritation which continues for a little while is allowed to subside before the procedure is repeated. Weak solutions are therefore employed more frequently, stronger ones less frequently. It is best to begin with this method 3 to 5 days after the menses, and to discontinue it 5 to 7 days before the next menstrual period.

Even the application of a strong solution of tannin, such as is employed in vaginal catarrhs, swelling of the mucous membrane, tendency to descent and prolapsus, may not be made too frequently.

The application of drugs in the shape of solids and powders is best made by means of the speculum. The neighborhood of the os uteri is cauterized with any sufficiently long caustic-holder, and by gradually withdrawing the speculum any part of the mucous membrane may be cauterized. Pure nitrate of silver or the mitigated stick may be employed. As a general thing we use the solid stick very little in these parts, and prefer strong solutions. But much depends upon the personal preference of the physician for this or that remedy or mode of application. General therapeutic principles, which apply to diseases of other mucous membranes, such as the nose, pharynx, conjunctiva, etc., offer a surer guide than the most detailed description of the methods of an individual gynecologist.

Powders, such as alum, may be strewn upon the mucous membrane by means of a spatula. A commoner mode of application is that of strewing the powder into and upon a tampon of cotton, which is placed in the vagina through a speculum, and upon withdrawal of the instrument is pushed out of its lumen by means of a pair of forceps. It is allowed to remain for 3 to 4 hours, and after its removal a cleansing injection is made. Tampons, which have been smeared with ointments of morphine, belladonna, etc., may also be inserted into the vagina.

Vaginal suppositories of fat, wax, butter of cacao, starch and glycerine, or gelatine as vehicles, to which morphine, atrophine, etc., have been added, have been recommended by Simpson, Tilt and others. They are uncertain in their effects, since we do not know how much is absorbed. The rectum offers a better site for application.

Vesicants have been recommended in chronic inflammations of the uterus, endometritis and perimetritis. A small piece of linen upon which emplastrum cantharides has been smeared is pressed against a portion of the vagina which has been cleansed of secretion, and is kept in place by means of a tampon. The plaster is kept in position from 8 to 10 hours. Considerable serous transudation usually follows, so that cleansing irrigations are indicated. Veit employs the solution of cantharides recommended by Johns (2 parts concentrated extract of cantharides in ether, 1 part of solution of gutta percha in chloroform). The remedy is applied with a brush.

Among others, the following cases of dangerous symptoms after vaginal injections in the non-pregnant condition have been reported:

E. Spaeth : peritonitis and death from injection of a solution of acetate of lead through the tubes into the peritoneal cavity. Ordinary syringe with ball valves (*Centralbl f. Gynaekol.* 1878, 25).

More Madden : peritonitis after astringent injections with a rubber syringe. The uterus was prolapsed, the os patulous (*Obst. Journ. of Great Britain and Ireland*, April, 1875.)

Thomas : vaginal injections with a Davidson syringe by the patient. Very violent pains followed by collapse. Patient recovered and had an attack of peritonitis. There were catarrh of the uterus, subinvolution and a very patulous os (*Amer. Journ. of Obst.* 1877, April, p. 263).

Kock's improved vaginal tube and vaginal douche during menstruation. Violent uterine colic and inflammatory symptoms from the accidental introduction of the vaginal tube into the cervix (*Centralbl. f. Gynaekol.* 1881, No. 19). Englemann reports two cases, one of severe peritonitis, the other of considerable peritoneal irritation In both cases the injection had been made in the sitting position with a rubber syringe (solution of tannin and warm water). Both patients suffered from retroversion and cervical catarrh.

Kisch (*Prag. Med. Wochenschr.* 1881, No. 5) observed parametritis 25 times as the result of vaginal douches. The patients suffered from various diseases, displacements of the uterus, and especially erosions of the cervix. Many of the cases were probably due to lighting up of old inflammatory processes.

Watery solutions of certain substances, which are inserted in the vagina by means of a cotton tampon, are absorbed very rapidly, as Hamburger showed with regard to potassium, iodine 15 per cent., potassium ferrocyanide, 9 per cent., salicylic acid, 2 per cent., potassium bromide, 6 per cent., lithion 10 per cent., solution. These substances appear in the urine 2 to 5 hours after their application.

INJECTIONS INTO THE UTERUS.—APPLICATIONS OF MEDICINAL SUBSTANCES TO THE CERVICAL CANAL AND CAVITY OF THE UTERUS.

Fluid substances are brought into contact with the walls of the cervix and the body of the uterus either by injections or by the application of a brush or small tampons of linen, etc., which have been dipped in the fluids.

Injections and irrigations need be considered only with reference to the cavity of the body of the uterus. We must distinguish between the introduction of small amounts of fluid and the irrigation of the uterus with large quantities.

In the former event we have to deal with strongly acting remedies, such as solutions of chloride of iron, nitrate of silver, tincture of iodine, which are applied to the inner surface of the cavity, either to check hemorrhage or relieve obstinate endometritis. This plan has secured adherents but has also found many opponents, who reproach it with the production of dangerous and even fatal accidents. We have made these injections very often, and believe that there is very little danger if proper precautions are adopted. But they can often be replaced by other methods which are not open to such objections. We have therefore restricted their employment, but very often use the innocuous tincture of iodine in catarrhs, slight hemorrhages, and as a disinfectant after curetting.

Irrigation is performed particularly in endometritis, but also to secure disinfection in all forms of intra-uterine treatment. Thus, this procedure is advisable after curetting, before the introduction of tents or dilators, but especially after their removal, after extirpation of tumors of the uterine cavity. It may even be necessary to adopt a sort of permanent irrigation, as in gangrenous processes or in degenerated, imperfectly enucleated fibromyomata.

Recent inflammatory processes constitute a contra-indication unless immediate danger to life from hemorrhage renders the introduction of an hæmostatic imperative. Ichorous processes may also necessitate cleansing of the uterine cavity.

Flexions and versions do not constitute an absolute contra-indication, if the cervical canal is sufficiently dilated and the anomaly can be corrected to such an extent during the procedure as to permit of the free escape of the fluid. Some writers mention an unusual irritability of the uterus as a contra-indication. This is said to occur despite the non-existence of inflammatory processes. The patient re-acts to the injection by extremely violent uterine colic, vomiting, attacks of spasm and syncope. It is always well, in very nervous individuals, to keep in mind the possibility of such accidents, and to begin with indifferent or slightly irritant remedies, such as tincture of iodine, and to make the irrigations under very slight pressure and at the temperature of the blood.

The rule holds good with regard to both methods of manipulation, that the cervical canal should be dilated, if its lumen does not suffice for the free escape of the fluid. It is true that we possess very narrow instruments which will pass through a very narrow cervix and still leave room for the escape of fluid, and, as a matter of course, they must be used before the introduction of a dilator. But in all other cases we do not see why the canal should not be dilated prior to the irrigation, if it can be done rapidly and without danger. Considerable dilatation is not required, and this can be effected up to 5 to 7 mm. without the use of force by means of solid bougies. If a thick catheter is employed for irrigation, dilatation is really effected, as it is with bougies, except that it is more violent and unmethodical.

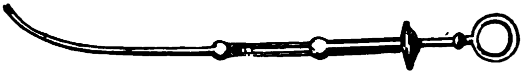

FIG. 41.

The following is the technique:

For the injection of small amounts of active remedies it is best to use Braun's syringe (Fig. 41); this is made of hard rubber, with the exception of the small glass cylinder.

The terminal tube, which is about as thick as an uterine sound and curved in the same way, has a small lateral opening near the tip, and is fastened by a screw to the glass cylinder. The syringe is apt to become defective after the frequent use of strong caustics, especially of chloride of iron. The connection of the terminal tube with the cylinder and the piston is especially apt to suffer. Immediate cleansing after using and prolonged immersion in water serves to keep it in good order. While it is being used the small opening may be stopped up by clots or mucus, and we may thus be led to exert too strong pressure and to inject the contents, after removal of the obstruction, too rapidly and forcibly into the uterine cavity. The patient is placed in the lithotomy position or upon the side, and the os uteri is exposed by means of a Sims speculum. The manipulation may also be made without exposure of the os. But this is less advantageous, since the escaping fluid then enters the vagina, while it can otherwise be absorbed by sponges or tampons. Moreover, as in all other intra-uterine manipulations, disinfection can be better performed after exposure of the parts. The syringe is introduced like an uterine sound, and the fluid is then injected by slowly driving the piston home. The narrow calibre of the opening prevents the rapid discharge and hence prevents rapid distension of the uterine walls with corresponding increase of pressure. During the injection attention must be paid to the outflow from the cervix, and it must be stopped at once as soon as the outflow ceases. The removal of the fluid by withdrawal of the piston has also been recommended. As a rule, not more than 3 to 10 drops should be injected, and this is easily read off upon the small piston rod.

Irrigations of the uterine cavity have been especially recommended by B. Schultze in endometritis. He first dilates the cervical canal with laminaria, and, by occasional application of his dilator, which acts in a sagittal direction, maintains the dilatation during the course of treatment. The irrigations are made in the knee-elbow position, and the portio vaginalis is exposed with a Sims speculum. Schultze uses simple catheters, of various curvatures and thicknesses (usually 5 mm. diameter), which have anterior and lateral openings. The irrigator is not held very high. About one litre of fluid is used at each application. Schultze generally uses a 2 per cent. solution of carbolic acid. The manipulation must be watched; as soon as the outflow of fluid is obstructed, the canal must be somewhat distended by means of the catheter and the pair of forceps, which grasps one lip of the cervix. If necessary, a dilator is introduced. Various instruments have been devised to permit the unobstructed escape of fluid, but as a general thing they have been abandoned, especially the double catheters, whose fenestræ are apt to become plugged. The best instrument is the Fritsch-Bozeman catheter, which Schroeder has provided with fenestræ at the tip. (Fig. 42).

Irrigations furnish a valuable addition to our therapeutic armamentarium. Their rational and methodical application is sometimes followed by astonishingly rapid recovery, even in old cases of catarrh. But in many cases they leave us in the lurch, and the treatment is usually more protracted and annoying than other methods, since the irrigations must often be used daily or every other day, for weeks. Nor are they as free from danger as Schultze claims. We must especially guard against the employment of too strong pressure. Very violent uterine colic and even symptoms of peritoneal irritation are observed occasionally, although no precautions have been overlooked.

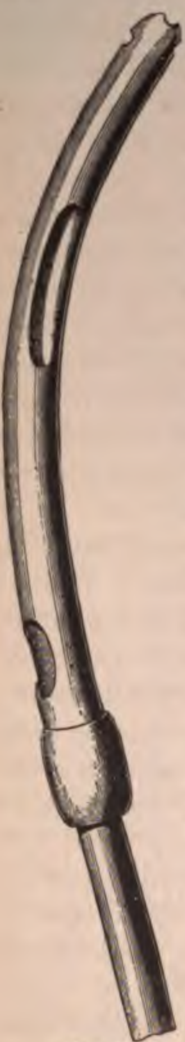

Fig. 42.

The accidents which have been observed after intra-uterine injections are undoubtedly due, in great part, to non-observance of the contra-indications, often to imperfect diagnosis or improper technique. In recent times, since the precautions are more fully understood, serious accidents are rarely reported. But individual peculiarities, and abnormalities in the structure of the organ, such as abnormal dilatation of the uterine orifice of the tubes, may give rise to dangerous symptoms, though we may be unable to make a previous diagnosis.

Violent uterine colic occurs not very infrequently, usually immediately after the manipulation; it may appear later, if an eschar-producing substance has been employed.

The injection is occasionally followed by extremely violent pain, pallor of the face, coldness of the extremities, a feeling of syncope, and an extremely frequent and small pulse. The attack may subside, or it may be followed by uterine colic, by a mild, occasionally severe and even rapidly fatal peritonitis. This may occur even if the injection has not been followed by such marked symptoms of shock.

Finally, sudden death has also been observed, attended with oppression and pain in the chest. This has resulted from the entrance of a solution of chloride of iron into the open veins of a subinvoluted uterus.

The symptoms of shock are to be explained by the sudden forcible distension of the uterine cavity and the strong action of irritant solutions. The entrance of fluid into the peritoneal cavity through the tubes also gives rise to shock and to peritonitis. It is doubtful whether this may also result from the pressure of the fluid, as the effect of the injection itself, into the substance of the uterus and vessels. On the other hand it is certain that caustic, irritant fluids may give rise to endometritis, and that the inflammation may then extend through the substance of the uterus to the peritoneum. This is so much more apt to occur when decomposition of the scurf or coagula in the uterus sets in, as occurs not infrequently after injections of chloride of iron. Under the latter circumstances the peritonitis does not develop acutely after the injection.

These dangerous symptoms have been particularly observed when improper apparatus has been employed. The selection of the remedy also exerts great influence. The most serious accidents have been noticed after the use of chloride of iron, chloride of zinc, or nitrate of silver. Tincture of iodine and tannin solutions very rarely are followed by unpleasant symptoms.

Perhaps we have grown too bold in recent times, since we have learned to guard against so many hurtful influences by careful disinfection. We must therefore lay stress on the fact that we are not entirely safe against unpleasant accidents, after the use of strong caustic and astringent remedies, even when all precautions have been adopted. Care must be taken even in copious irrigations with bland fluids, and the precautions concerning the escape of the fluids, etc., must not be neglected. The genesis of inflammatory processes after injections is clear in great part but not entirely, and so long as this is the case we are confronted by an unknown enemy. The thousands of cases in which no bad effect ensues, cannot alter our opinion. *A priori* it is not to be supposed that even in a more innocent manipulation than the use of injections, a serious accident should not occur occasionally among the thousands of cases.

The other methods of applying substances which have been dipped in various fluids to the uterine mucous membrane, are less frequently attended by unpleasant symptoms. The mode of application to the cervical mucous membrane is very simple. A brush which has been dipped into the fluid is introduced into the cervical canal, or a glass rod or uterine sound is moistened with the concentrated remedy. If the internal os is wide and the entire cavity is straight, the uterine sound or a brush fastened to a long handle may be introduced into the cavity of the body of the uterus. Even in this way a sufficient amount of the fluid will come in contact with the mucous membrane of the body of the uterus.

But if these favorable conditions are not present (when the canal is narrow or flexed), and if a larger amount of the remedy must be applied to effect our object, other methods of application must be adopted. A very serviceable plan consists in the introduction of an instrument like a sound, which is wrapped in absorbent cotton or linen and dipped in the fluid. Artificial dilatation of the cervix is often necessary or at least very useful as a preliminary; flexions or displacements of the organ should first be relieved as much as possible.

Kristeller recommends a quadrangular flexible sound of German silver, with two narrow and two somewhat broader sides, which increase somewhat in size from above downwards. This sound is covered with a band of long-fibred soft cotton, the tip being first encircled and the cotton then twisted spirally around the instrument as far as required. The individual twists should not be applied too firmly. The curvature of the sound and the thickness of the cotton may be varied according to circumstances. A second crutch-shaped instrument, in whose transverse band is a slit which fits the sound, is employed to prevent the removal of the cotton on the withdrawal of the sound. As the sound is removed this slit is passed over the free portion of the sound as far as the cotton, and, while pushing the crutch gently against the cotton, the sound is withdrawn through the slit.

Kristeller has recommended this plan for tampons of the uterus, and also for the applications which are smeared upon the cotton. In the former the entire cotton tent is moistened with glycerine, in the latter those parts of the cervical canal, which are not to come in contact with the remedy, are pencilled with glycerine before the introduction of the sound.

A similar method of applying caustic, astringent or irritant fluids to the uterine cavity or cervical canal has recently been extensively adopted. The instrument employed is a flexible wire of copper or aluminium, which is notched for 6 to 7 cm. of the uterine extremity. A strip of long-fibred cotton is wound around this part. This is then dipped into the solution and introduced into the cavity of the uterus after exposure of the portio vaginalis. The wire is first curved in a direction which corresponds to the course of the canal, as shown by introduction of the sound. The wire is allowed to remain as long as necessary for the required action of the remedy.

If the cavity of the body of the uterus is alone to be treated, the cervical canal must be protected by a cervical speculum. Small bivalve or cylindrical specula of hard rubber, ivory, etc., have been devised (Fig. 43.) They are 4 to 5 cm. long, and provided with a suitable handle or staff for introduction.

Their insertion must often be preceded by dilatation of the cervix. The speculum, if introduced into the canal, at least protects the walls against direct contact, an important element in the application of strong caustics, because otherwise the chief action of the remedy would affect the cervix.

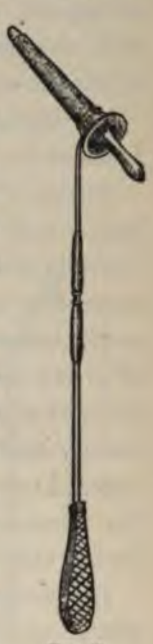
FIG. 43.

Fuming or ordinary purified nitric acid has been especially employed. In chronic catarrhs with considerable secretion, in subinvolution of the uterus, hemorrhages and menorrhagias, with swelling and hyperplasia of the mucous membrane, this remedy often furnishes very good results, and, if the necessary precautions are adopted, and inflammatory conditions are not present in the vicinity of the uterus, etc., is devoid of danger. In gonorrhœal endometritis it is questionable whether the treatment should not be more vigorous than that ordinarily adopted. If the infection is confined to the uterus, there need be no hesitation in acting upon the diseased mucous membrane by irrigation or cauterization. But in most cases we have to deal with distinct symptoms of implication of the tubes and pelvic peritoneum. Without energetic interference we may expect the development of protracted, usually not thoroughly curable disease, pyosalpinx, occlusion of the fimbria, secondary cystic degeneration of the ovary (small cysts) and pelvic peritonitis. Active treatment, on the other hand, is attended with the risk of a severe, acute peritonitis. In such cases we have recently employed repeated cauterization with nitric acid. In a nullipara there was even a swelling on the left side attended with pain, although the infection was of short duration. The result was extremely favorable. In this case conception occurred after the lapse of a not very long period. But our experience is not sufficiently large to justify us in recommending a deviation from the rules generally laid down.

Stenosis of the canal and even extensive atresia have been occasionally observed after cauterization. We can guard against this, on the one hand, by using the cervical speculum, on the other hand, by keeping the patient under observation during the exfoliation of the eschar and the subsequent healing of the wounded surface, by testing, from time to time, the permeability of the canal with the sound, and, if necessary, by dilating it with bougies.

The application of medicaments in the solid form to the mucous membrane of the cervix and the body of the uterus is made in various ways.

Nitrate of silver is the remedy which is most frequently employed. A long caustic holder suffices for applications to the cervix (Fig. 44), or the solid stick is introduced with the aid of a pair of forceps. The neighborhood of the os uteri and portio vaginalis is protected by cotton. A special apparatus is required for the uterine cavity. Chiari's instrument (Fig. 45) consists of a fenestrated tube containing the nitrate of silver, and fastened by a screw to a hard rubber or metallic rod. The spoon-shaped cautery holders (Fig. 46)—long silver tubes and a spoon, which are fastened to a silver wire—are also very serviceable. The scoop, in which the nitrate of silver is melted, is concealed within the tube and then pushed into the uterus.

The construction and use of Scanzoni's apparatus are sufficiently explained by Fig. 47.

A third apparatus, Martin's so-called uterus-pistol, is constructed in such a way that after its introduction a piece of lunar caustic may be projected into the uterine cavity and there allowed to dissolve (Fig. 48). Other substances may also be inserted in the same way. Teutleben recommends the introduction of pencils of pure chloride of iron by means of Chiari's apparatus. The instrument remains in position until the iron has dissolved and escaped through the fenestræ. We have introduced this preparation of iron with the uterus-pistol and have obtained very good results in hemorrhages and subinvolution.

Before using an instrument we should see that it is in perfect order. This holds good especially with regard to the spoon-shaped porte-caustique, since the scoop, whose connection with the wire is apt to be attacked by the caustic, may be left behind in the uterus. If the cervix is narrow it should be first dilated. Larger instruments with a greater amount of nitrate of silver may then be introduced. The caustic is soon surrounded by an eschar, which prevents its further action on the mucous membrane. The instrument should therefore be turned a number of times around its long axis or be pushed to and fro. It must be kept in position for 3 to 5 minutes before the caustic has melted. The brown pulp,

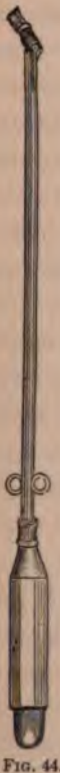
FIG. 44.

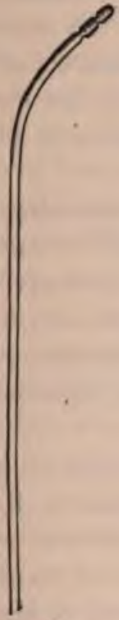
FIG. 45.

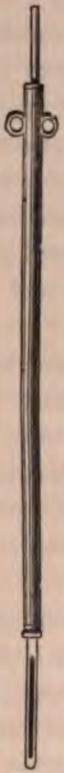
FIG. 46.

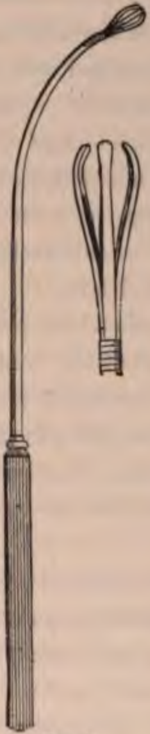
FIG. 4.

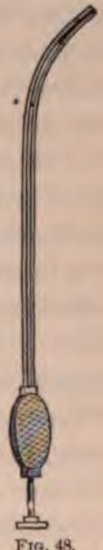
FIG. 48.

ich flows from the os uteri, is caught by means of cotton. On this account alone it is advisable to use a speculum, although cauterization may be performed without the aid of this instrument. The cautery holder ntroduced in the same way as the uterine sound.

The patients often complain of burning during and after the cauterion. Subsequently they suffer not infrequently from uterine colic, ich is sometimes very violent and may last 12 to 24 hours. A grayish wn or sanguineous discharge appears, and as soon as this becomes profuse the pains subside; abundant losses of blood are rare. We have often employed these cauterizations and have never observed any notable bad results. The symptoms mentioned above always remained within certain limits. The exfoliation of the eschar and the increased irritation of the mucous membrane persist for 5 days or more, and it is not advisable to make more than two applications within one menstrual interval. We have also made it a rule to keep the patient in bed for two days. Caution is demanded in cases of considerable version and especially of flexion. If the position and shape of the uterus can not be improved, we must remain satisfied with mild applications, and in pronounced flexions must desist entirely. This is also true of inflammatory affections of the vicinity and appendages of the uterus. The cauterizations are indicated in chronic endometritis corporis with swelling of the mucous membrane, menorrhagias or even hemorrhages in the intervals. This plan is recommended in subinvolution and catarrh of the organ after the termination of child-bed.

These cauterizations are also employed after abortion (1 to 2 weeks after the discharge of the ovum), when bloody or blood-tinged secretions are caused by the retention of portions of the ovum or swelling of the mucous membrane, and also after the removal of soft tumors from the cavity of the uterus. In all of these conditions they are not infrequently of decided benefit, but are less certain than injections or the use of nitric acid.

Becquerel first recommended the application of sticks of powders, which were prepared by the addition of tragacanth. He used suppositories of tannin, starch, and gum tragacanth, which were about as thick as a stick of lunar caustic, and were provided with a thread which ran longitudinally through the middle. As they are apt to break it is well to add glycerine to the mixture. If they are sufficiently long they may be pushed not alone into the cervix but also into the body of the uterus by means of a pair of forceps; this requires exposure of the os uteri. The indications are similar to those of cauterization with nitrate of silver. The irritation is generally greater, and appeared to us to last longer than after the use of lunar caustic. The measures required after their application are the same as in the previously mentioned manipulations. Sesquichloride of iron, oxide of zinc, sulphate of copper, sulphate of zinc, and acetate of lead may be employed in the same way. Martin recommends that these sticks be made of the substances mentioned, with pulv. altheæ and glycerine. They should be 2 to 3 cm. long and inserted with the aid of the uterus-pistol.

Powders, such as calomel and alum, have also been applied to the mucous membrane of the cervix by means of similar apparatus.

Fraenkel recommends sticks of pure alum in catarrh of the cervix and body of the uterus, subinvolution, and pyometra.[1]

Numerous cases of dangerous and fatal accidents after injections have been reported in former and recent times. Autopsies have shown that the solution entered the abdominal cavity through the tubes. In Cederskjoeld's case, in which chloride of iron also entered the pelvic veins, and the inferior vena cava as far as the right heart, death from thrombosis rapidly followed; the instrument employed and the amount of fluid injected are not mentioned. The uterus was sub-involuted and vessels were found which were open towards its cavity. In Kern's case, which terminated fatally from peritonitis, a solution of chloride of iron was injected by means of an ordinary uterine syringe (!) In my case an elastic catheter and a sort of clap syringe were used. The uterus was very flabby and thin walled. Thomas observed very frequent pulse, collapse and agonizing pain after the injection of equal parts of sulphate of iron and glycerine; mild peritonitis followed. Cory (*Trans. of Lond. Obst. Soc.* XXI, 880, p. 51) reports the following case: hemorrhage for more than 2 months after abortion, after remnants of the ovum had been discharged. Injection of chloride of iron (1 : 10) with Higginson's syringe, containing 38 gr. of fluid. After the 2nd injection collapse and death. An open tumor on the anterior wall of the uterus, composed of degenerated villi, which penetrated nearly to the serous membrane. Left tube of a black color. Small amount of black fluid and clots which contained sulphate of iron, etc., in Douglas's *cul-de-sac.*

Engelman reports a case of sudden death, five minutes after injection of 60 grm. iodine in a case of fibroma; nothing found in abdominal cavity.

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[1] Vidal, in his experiments on corpses, found that fluid entered the tubes and uterine vessels, only after forced injections. Hennig corroborates this statement. Klemm found that if the cervix was ligated a moderate pressure will drive the fluid through the tubes. It entered the veins of the uterus and broad ligaments even more readily.

It is evident that imperfect technique was the chief factor in these serious accidents, though this cannot be proven with regard to all cases. The experiments on the cadaver show that entrance into the tubes takes place only after considerable pressure and that, under ordinary circumstances, especially when the lumen of the cervical canal is normal, this is hardly possible. Yet we are unable to determine whether unusual conditions are not present in any given case. Weber observed considerable dilatation of the abdominal opening of the tubes in two cadavers; in one it was as large as a raven's quill, in the other it admitted the little finger. Bischoff also found a funnel-shaped dilatation of the left tubal opening. Schwarz found that the introduction of a solution of chloride of iron, nitrate of silver or tincture of iodine into the abdominal cavity of dogs, did not even give rise to an adhesive inflammation. But these experiments do not decide the question at issue. Injurious substances are very apt to be carried along by the injection fluid in its passage through the tubes.

APPLICATION OF PESSARIES AND SIMILAR INSTRUMENTS IN THE VAGINA.

These instruments are applied either to replace simple descent and prolapse of the uterus and vagina or to correct versions and flexions.

The pessaries, which are used for descent and prolapse of the uterus and vagina, may not be introduced into the vagina until the chief complications of these conditions, particularly ulcerations and inflammatory irritation, are relieved. All pessaries possess the great disadvantage of irritating the vaginal mucous membrane, usually producing a foul-smelling secretion which is with difficulty kept in check. Spontaneous recovery rarely occurs during their use; on the contrary larger pessaries must often be introduced in order to maintain the reposition. In addition they sometimes give rise, though, as a rule, only when improperly applied, to ulcerations, perforations, fistulæ, parametritis and peritonitis. Certain anatomical changes must result from the distension, pressure, etc., even if the pessary is properly applied. In our opinion the instrument is merely a makeshift, since every prolapsus, unless caused by a tumor, is curable by operation. The indications for the use of the pessary in prolapse are only furnished when local and general morbid conditions prevent the operation. This is also prevented by old age, although we have successfully performed it at an advanced age.

The introduction of a pessary into the vagina must be preceded by the reposition of the prolapse. This generally occurs spontaneously in quiet dorsal, lateral or knee-elbow position. In order to perform manual reposition the tip of the tumor is grasped by the tips of the fingers and pushed through the introitus like a hernia. If this meets with considerable resistance on account of inflammation or œdema, assistance is afforded by quiet position, support of the prolapse, and cold compresses. After having tried all sorts of pessaries for a long time we have finally returned, at least in the large majority of cases, to the old ring pessary (Fig. 49). The simplest possible apparatus is rendered necessary by the fact that we have to deal chiefly with working people, who are in part not intelligent enough, in part are able to spend little time and money upon themselves. Apart from these considerations the ordinary round pessary appears to us to be the most serviceable. In some cases an oval pessary (Fig. 50) furnishes good results. A solid india-rubber instrument is very convenient, and is also advantageous on account of its yielding character, though this is very limited. The unpleasant feature is the tendency to decomposition, so that a discharge is usually produced. Prochownik's hard rubber pessaries are very light, smooth and clean.

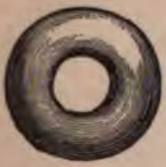

Fig. 49.

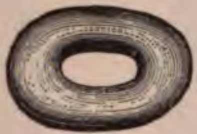

Fig. 50.

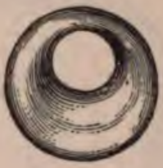

Fig. 51.

Much depends upon the opening in the ring. As a general thing the opening should be large, though everything depends on the condition of the vaginal walls. If the latter are very corrugated and flabby, so that they push through the opening, the latter must be correspondingly smaller. In slight prolapse when the vagina is still rigid to a certain extent, we can effect our purpose occasionally with the aid of Mayer's rubber ring and lever pessaries, which will be described later. The so-called eccentric ring pessaries (Fig. 51) (with a non-central opening, the narrower rim corresponding to the side towards which the opening is placed) are advantageous in those cases in which the body of the uterus, after its reposition, curves strongly towards the concavity of the sacrum and can not be brought in another position. Prochownik prefers them in general because they possess a thicker part which fits into the capacious vault of the vagina, while the thinner part corresponds better to the anterior portion of the vagina, where pressure upon the urethra and symphysis are to be avoided.

Very good results are obtained, especially in isolated prolapse of the anterior vaginal wall (cystocele), from Schatz and Prochownik's pessaries (Fig. 52), which are provided with openings for the escape of the secretion. They are made of hard rubber.

The instruments are introduced in the lithotomy position. With one hand the physician separates the labia, carefully pushes the hair aside, and places the pessary, which has been lubricated with oil or glycerine, obliquely within the introitus, so that the opening of the urethra is left untouched. In its passage through the introitus the ring is pressed firmly against the perineum. With a somewhat rolling movement the ring is then pushed rapidly through the introitus. When it is within the vagina it is followed by a finger and placed in such a position that one surface is directed towards the posterior vaginal wall. Special care must be taken that the posterior rim of the instrument is not situated in the anterior vaginal vault, and thus presses the cervix against the sacrum. If this happens the curved index finger is passed into the opening, grasps the posterior part of the ring, draws it down in order to free the portio vaginalis, and then pushes it up behind the latter. At the same time the anterior portion of the instrument may be pushed upwards. The improper position is assumed more readily by small instruments. After the ring is in position the tension of the vaginal walls is examined.

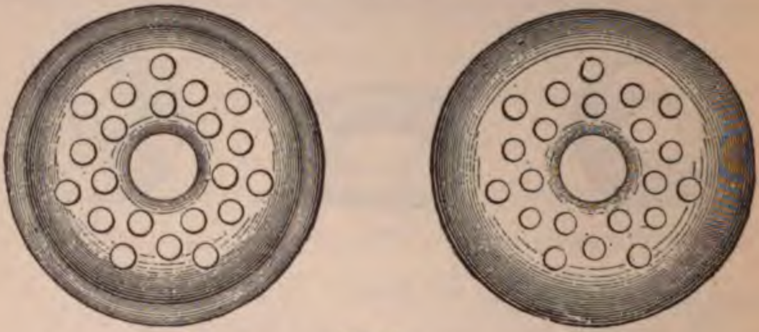

FIG. 52.

This should not be great. Nor may the patient complain of considerable pain, pressure on the rectum or bladder. She is allowed to bear down and walk about, and an examination is then made. The patient must be kept under observation for a few days while she is attending to her usual duties. Lukewarm irrigations of the vagina with some disinfectant should be made daily. The instrument is removed every 4 to 5 weeks and cleaned, the vagina is examined, and the pessary again introduced. Its introduction by the patient or some ignorant midwife should be prevented.

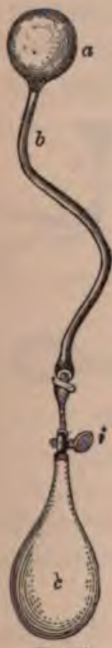

FIG. 53.

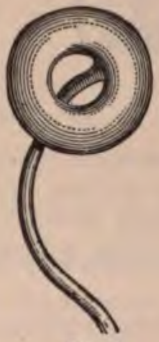

FIG. 54.

Gariel's air pessary consists of an oval rubber bag (Fig. 53), which is connected with a tube (*b*) and a second bulb which is used to distend the first one. After the introduction and distension of (*a*), the stopcock at (*i*) is closed, and the bulb (*c*) is then removed.

This simple bag is now replaced by ring pessaries of the ordinary shape; even the central opening is retained (Fig. 54). Some are unconnected with a tube. They are either filled hermetically with air or are filled through an opening in the ring itself.

These very elastic instruments are occasionally very useful in slight prolapsus, in well-to-do patients, and during pregnancy. The simple air bag may be introduced by the patient, so that it need not be retained at night.

The hysterophore, combined with a pelvic belt, is intended to replace the apparatus just described when the prolapsus is so great, and the relaxation or imperfections of the soft parts are so marked, that the ordinary instruments no longer find a support. The belt is either inelastic or possesses a spring. When this no longer finds the necessary support, it may be provided with suspenders. In Breslau's hysterophore (Fig. 55) elastic bands, which are fastened by means of buttons, pass anteriorly and posteriorly from the belt. These unite in a sort of disk, made of leather or rubber, from which rises a stem that supports the pessary proper.

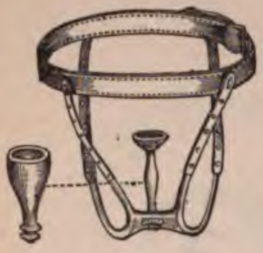

FIG. 55.

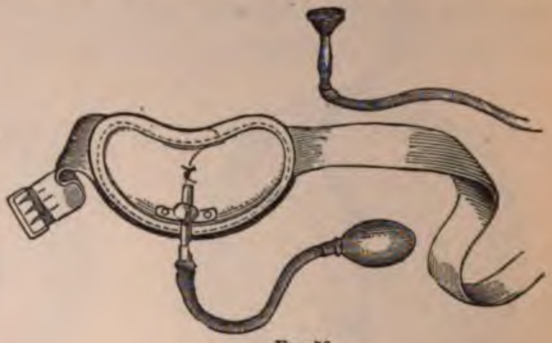

FIG. 56.

In Scanzoni's modification of Roser's apparatus (Fig. 56) the pelvic belt possesses a shield which corresponds to the edge of the symphysis. With this is connected a curved stirrup, the end of which, inserted into the vagina, bears the pessary. The stirrup may consist of a steel spring, carrying a sort of oval cushion which is applied to the anterior vaginal wall, lifts the latter and presses it against the symphysis. Or the stirrup is composed of an inelastic metal rod, which carries any pessary desired. The stirrup may also be divided into two parts; the upper part, which is fastened to the cushion over the symphysis, may be moved up and down, *i. e.* lengthened or shortened by means of a hinge. United to this by a joint which permits of lateral motion is the metallic rod which supports the pessary.

The same rules hold good concerning the application of these instruments as of simple pessaries. The patients are kept under observation for several days, and the hysterophore is modified according to the results of our examination. The belt, stirrup, spring or inelastic metallic rod, and particularly the pessary, must be adapted to each individual case. Our objects will often be attained if we take sufficient pains and carefully instruct the patient in the use of the instrument. But this is not always true. Thus, unconquerable obstacles are often created by very marked relaxation of the vaginal walls, especially the posterior wall, and which is sometimes complicated by prolapse of the rectum.

In such cases, and also in very old people, in marked prolongation of the cervix (if an operation is refused), in prolapse resulting from tumors, we may employ a simple perineal cushion. These consist of variously long (extending beyond the anus if the rectum is also prolapsed) and broad cushions of wood, gutta percha, hair covered with rubber and rubber balls distended with air.

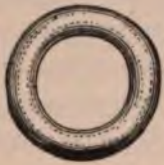

FIG. 57.

These cushions are connected with a pelvic belt by means of straps and rubber bands. The cushion covers the introitus and perineum, and is intended to prevent or at least impede the exit of the vaginal walls and uterus from the vulva. A T.-bandage, to which a cushion or sponge is fastened, may be used as an imperfect substitute.

Simple rubber rings, particularly the so-called Mayer ring (Fig. 57), and sometimes eccentric pessaries, are employed in normal positions of the enlarged uterus, and also in versions and flexions, even if the uterus has not been replaced. The object sought for was to diminish, by means of a support, the symptoms which were caused by the weight of the enlarged organ, and to produce a certain degree of fixation of the uterus. It cannot be denied that Mayer's ring sometimes produces considerable relief in cases of old enlargement with normal position of the uterus, but it is difficult to give an accurate description of the cases in which this happens. But it will sometimes pay to make the application in simple enlargement, which is associated with a feeling of bearing down, pains in the groins and small of the back. Furthermore, we have sometimes obtained decided benefit from the introduction of a ring in anteversions (rarely anteflexions), associated with enlargement of the uterus and annoying pressure on the bladder, although the position of the uterus was not improved. Successful cases of this kind are not common. We remember only two cases of pure anteversion of the uterus with enlargement, in which the result was a brilliant one, inasmuch as all the symptoms disappeared at once. In the menorrhagia of anteversions, with coincident enlargement of the uterus, the ring also appeared occasionally to have a favorable effect.

It is also successful in some cases of retroflexion, with or without retroversion, in which permanent retention cannot be secured. At least the subjective symptoms and hemorrhage are relieved in individual cases. We would here recommend simple rubber rings, in which the diameter of the cylinder constituting the ring is not too small. In using ordinary lever pessaries the relatively thin stirrup presses into the substance of the uterus, and thus increases the flexion or produces a groove in another situation. In cases of unusual softness and flaccidity of the uterine walls we have seen good effects from eccentric pessaries, especially in checking the abundant hemorrhages. We attribute the good effects to the pressure and the consequent irritation, less to the often very slight rectification of the displacement. The introduction of a simple rubber ring filled with air, or a Gariel air-bag in the posterior vaginal vault, occasionally exercises a favorable influence. Good effects have even been obtained from the introduction of small round cotton tampons or sponges.

In parametritis and pelvic peritonitis, after the acute stage has run its course, great relief of the symptoms, especially of the pain in the back and abdomen, and the bearing down, is sometimes produced, by the introduction of a pessary. This effect is probably owing to the fact that the sensitive ligaments are no longer dragged upon. In addition, the restoration of increased pressure within the vagina may also be advantageous, especially if the introitus is soft and the vaginal sphincters very insufficient. Under such circumstances tampons are first used, and then soft, yielding pessaries are introduced tentatively. Ring pessaries filled with air are suitable for such cases.

The instruments under consideration are often employed because, in certain cases, they render permanent the reposition of the retroverted or retroflexed uterus which has been effected by other means.

The reposition of the displaced organ may be effected with the finger or by means of instruments. If the uterus has rigid walls the organ may sometimes be replaced by merely pushing the cervix, with the finger, against the sacrum. If this does not suffice, rectification of the position by means of combined manipulation becomes necessary. The position which we have recommended for abdominal palpation (trunk horizontal, thighs flexed at right angles to the couch) is especially serviceable for our purpose. If necessary an anæsthetic may be administered in order to produce further relaxation of the abdominal walls. The bowels and bladder must be emptied. The finger which is introduced into the vagina either pushes back the portio vaginalis or first passes into the posterior vaginal vault and pushes the fundus uteri upwards; after this has been done to a certain extent, the manipulation is performed upon the cervix. The hand which rests on the abdominal walls attempts to reach the promontory of the sacrum with the tips of the fingers, searches for the fundus in this position or in the lateral portions of the pelvis, and then attempts to reach the posterior surface of the body of the uterus. This is pushed forwards, while the finger of the other hand pushes the portio vaginalis backward. If the external hand reaches the posterior surface of the uterus, reposition is assured, provided that adhesions are not present. Reposition is effected still better if one or two fingers are introduced into the rectum, and the thumb into the vagina. The former push the fundus upward and forward, the latter pushes the cervix backward. The outer hand seeks the posterior surface of the uterus and draws or pushes this forward. At the same time we obtain positive information concerning obstructions and adhesions. An anæsthetic must be administered in difficult cases and in sensitive individuals. A pair of forceps, which grasps the portio vaginalis and draws it downwards and backwards, is very serviceable. This traction renders it much easier for the finger, which has been introduced into the vagina or rectum, to reach the posterior surface of the uterus and push it forwards. When this has been done the index finger in the vagina, or the thumb (which has been introduced into the vagina at the same time that the finger has been inserted into the rectum), pushes the cervix backwards and upwards. If the walls of the uterus are somewhat rigid, the organ may be replaced with the forceps alone, by drawing the cervix at first downwards and backwards. then pushing it upwards and backwards. Reposition is sometimes facilitated in the lateral, latero-abdominal and knee-elbow positions. The outer hand then encounters greater difficulty in reaching the posterior surface of the organ, but this can usually be done. The assumption of the simple knee-chest position for spontaneous reposition or at least improvement of the displacement, is not inadvisable, since it is apt to increase the retroversion. The bladder and viscera sink and carry with them the cervix, which meets with no obstruction. The promontory often opposes a change in the position of the fundus. If a Sims speculum is introduced, and the posterior vaginal is raised, the cervix is pushed towards the perineum and the fundus moves upwards. The entrance of air into the vagina, which takes place at the same time, is not the cause but the effect of the upward movement of the uterus. Complete reposition of the organ in the knee-chest position takes place with certainty only after pressure on the fundus through the rectum, or distension of the latter with water or air, or traction downwards and backwards upon the cervix with forceps. In individuals in whom, despite the mobility of the retroversion, a ring is not tolerated, the knee-chest position should be assumed several times a day for 5 to 20 times, and the anus distended with the finger or a small cylindrical speculum until the rectum is distended with air. In addition, ½ to 1 litre water should be introduced daily into the rectum in this position and retained as long as practicable. This also serves to secure soft evacuations.

In difficult cases Schultze recommends temporary dilatation of the cervix with laminaria, then introduction of the finger into the uterine cavity, and replacement by its aid.

As a general thing the sound should not be employed to replace the uterus. If the retroversion is the result of flaccidity, the diagnosis and reposition are almost always very easy and the use of the sound superfluous. But in difficult cases, the condition of the ligaments and uterine appendages must first be determined by careful rectal exploration, before we may think of mechanical treatment. If such an exploration is made, the uterus may be replaced at the same time. But reposition with the sound does not end the matter. The hand upon the abdomen must then attempt to pass to the posterior surface of the uterus, in order to convince ourselves that the organ is in proper position. In this examination a part of the manipulation that is required by the manual reposition is necessary. We consider the sound as never suitable for a first replacement. It is better to administer an anæsthetic, after which the uterus is easily restored to position, unless adhesion and retraction of the ligaments render it impossible. In very sensitive individuals the use of the sound is permissible when the reposition must be frequently repeated. But the methods described above will usually render this unnecessary even for the inexperienced physician. The rupture of adhesions by means of strong steel sounds, as performed by Erich, is to be utterly deprecated. Indeed, it may be doubtful whether a fixed retroversion should be subjected to any considerable attempt at reposition, even by the hand alone. The displacement is very often owing to the fact that the posterior layer of the broad ligament is adherent to the posterior pelvic wall or that the degenerated tube or ovary is adherent posteriorly. In such cases an attempt would be useless and not free from danger. Even when the body of the uterus is adherent to the rectum or other part of the posterior pelvic wall, the results are generally unsuccessful. The process is almost always extensive and severe, and the tubes and ovaries are very often affected. The uterine displacement is only a part-symptom, a sequel, which perhaps causes an aggravation of the symptoms. But the latter are due chiefly to the other pathological conditions and will not be relieved by rectification of the malposition, indeed they may even be increased by violent procedures. It is only when isolated bands of adhesions can be easily separated and the tube can be recognized with certainty as undilated, that we would recommend separation of the adhesions by passing the hand downwards along the posterior surface of the uterus.

Reposition usually converts retroversion into anteversion, retroflexion into anteflexion. Hodge's lever pessary (Figs. 58, 59 and 60) furnishes a very good means of keeping the uterus permanently in the new position. These pessaries may be made of cellulose, gutta percha, nickel, aluminium, hard rubber, thick copper or aluminium wire covered with rubber. Those of hard rubber are very clean and smooth. The shape varies extremely, but is, in general, an oval or elongated quadrangle with rounded angles. The horse-shoe shape, in which the pessary is open anteriorly, has been abandoned on account of the pressure against the anterior vaginal wall. The anterior and posterior parts often vary in width. If the pubic part is too narrow, it sinks deeper into the introitus during walk-ing and standing and thus produces a very annoying sensation; if the pubic extremity is too wide, it presses the vagina too firmly against the bones, and thus is apt to produce necrosis from pressure. The calibre of the cylinder constituting the ring is often too small, and a deep furrow may then be pressed into the tissues. The essential feature of the instrument is the curvature of the anterior and posterior parts above the level of the middle portion. In some the curvature is in an upward direction, both anteriorly and posteriorly; more frequently the posterior part is curved upwards, and the anterior part is curved downwards or remains in the plane of the middle portion. The anterior transverse piece may also have a posterior curvature, in order to avoid pressure on the urethra. An

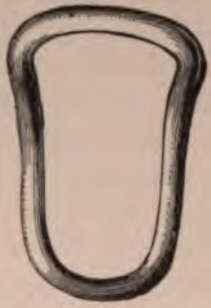

FIG. 58.

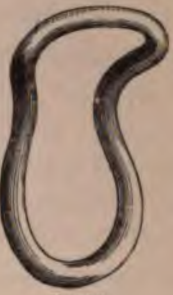

FIG. 59.

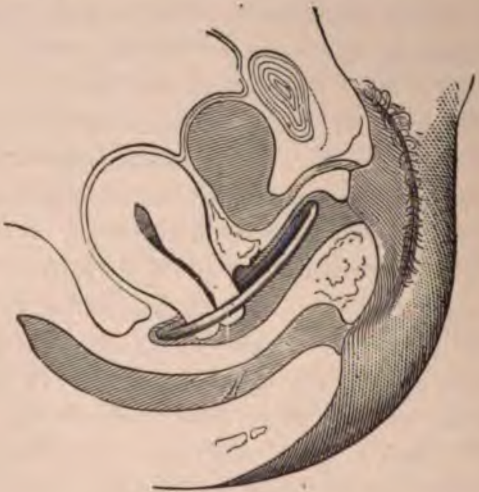

FIG. 60.

upward curve of the anterior extremity is apt to flex the urethra and thus produce difficulty in micturition. The degree of curvature also varies greatly. It may be so marked at both ends, that a middle portion can hardly be said to exist, or there is a very steep curve posteriorly, so that this part is almost at right angles to the middle piece.

Different views are entertained concerning the mode of action of lever pessaries. Some believe that a lever effect is actually produced. A well-applied pessary is mainly supported by the elastic vaginal wall and the levator ani. The middle piece receives its support on the posterior vaginal wall (Emmet), or on the latter through the medium of the levator ani (Prochownik), and this forms the fulcrum. The intra-abdominal pressure, which acts chiefly through the anterior vaginal wall, pushes the long anterior arm of the lever downwards. This is opposed by the resistance of the tense levator ani, which acts upon the short arm of the lever in the posterior vaginal vault. The portio vaginalis is drawn backwards by the upper extremity of the instrument and is forced behind the middle of the pelvis. Contact of the pessary with the bones (symphysis, rami of the pubis) does not come into question, according to Prochownik, and indeed must be carefully avoided, as it could not be tolerated by the patient for any length of time.

If the pelvic peritoneum is in good condition and the vagina is elastic, the pessary, kept in position by soft parts alone, may maintain the uterus in its normal position. But such conditions are not common. On the contrary, in the retroversions due to relaxation, which form the principal contingent for mechanical treatment, not alone the peritoneal supports of the uterus, but the floor of the pelvis and the elasticity of the vagina have suffered. The lever pessaries must therefore receive a certain support from the ramus of the pubis, especially because, on account of the frequently imperfect closure of the introitus, the anterior branch of the pessary, if it were not applied to the bone, would be pushed through the introitus during vigorous abdominal pressure, and would produce an extremely disagreeable sensation.

In such cases the anterior branch must possess a certain breadth or it must even be curved upwards. If this causes pressure on the urethra, a curve may be introduced at the point of pressure. When the pessary is supported by the symphysis it acts by pushing the portio vaginalis backwards the whole length of the instrument, on account of the tension of the posterior vaginal vault. Special care must be taken that the vagina is not stretched too much transversely. Hence Emmet requires that we should be able to introduce the finger conveniently between the pessary and the vaginal wall. The posterior branch may not press against the junction of the cervix with the vagina, but must be situated further backwards. Emmet determines the length of the instrument by measuring with the finger the distance from the symphysis to the posterior vaginal vault. This, less the thickness of a finger, corresponds to the length of the pessary.

The curvature of the posterior part in such a way that the greater part of it is applied to the posterior vaginal vault, favors its fixation. But this has its limits, and an excessively deep curve, which stimulates the elastic reaction of the tissues too much, may destroy the desired result. We have long discarded the use of instruments with extreme curves. The length, shape and breadth of the pessary must be adapted to the individual case; hence we prefer those which are made of flexible wire, covered with rubber, because any shape desired may be given them. Much more cleanly and therefore decidedly preferable, if we possess them in sufficiently large numbers, are the hard rubber pessaries whose shape, after they are warmed, may also be changed.

We will often be compelled to try various instruments and to keep the patient under observation for several days, in order to determine the effect produced—whether it causes difficulty in micturition or defecation, a feeling of tension in the abdomen, etc. It is well to recommend the patient to maintain the lateral, latero-abdominal or even abdominal position, at least for longer or shorter periods. The urine should not be retained too long, and soft evacuations from the bowels should be secured. Before the patient is dismissed from observation, we must satisfy ourselves that the uterus is in a good position and that the instrument exercises no injurious pressure or irritation.

It sometimes happens that the portio vaginalis, after a certain length of time, again passes anteriorly, because the previously tense vagina relaxes. A larger pessary must then be inserted. But this is not often necessary if the first selection is properly made, and we have allowed patients to wear the same hard rubber pessary for years.

Various measures have been devised to retain the cervix posteriorly with greater certainty.

Freund recommended that a somewhat thick lead wire be imbedded in the anterior lip of the os; at the end of 3 or 4 days a Hodge's pessary is to be introduced and the wire fastened to its posterior branch.

Schultz devised an 8 pessary, in whose small posterior ring the portio vaginalis is inserted, so that the cervix is not held back by the vaginal tension but by this ring. This pessary possesses the great advantage that it is comparatively short, especially if it receives a certain support anteriorly at the symphysis. It then holds the cervix posteriorly for a distance equal to its own length, even if the vagina is flaccid. An injurious effect may be produced by constriction and consequent swelling of the lips of the cervix. If the posterior ring is made large, in order to prevent this, it is apt to exercise too much tension. Furthermore the point of the intersection of the 8 is too thick. Finally, these pessaries can hardly be made of any other material than wire covered with rubber, and hence the decomposition and secretion are considerable.

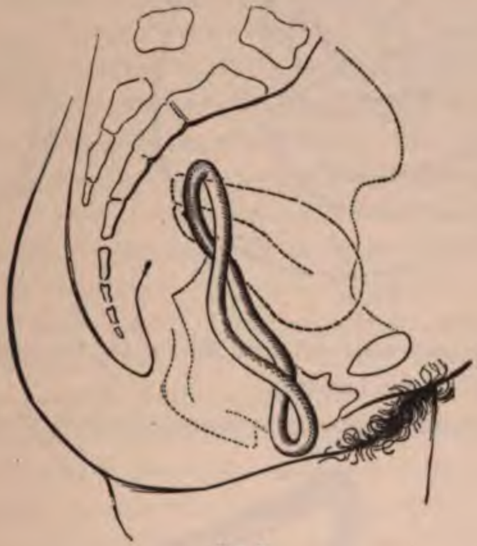

FIG. 61.

In other cases Schultze employs the so-called "sleigh pessary" whose anterior extremity is curved strongly backwards, and, resting against the anterior wall of the cervix, prevents its approach towards the symphysis (Fig. 62).

Thomas's pessary (Fig. 62 *a*) is also recommended in difficult cases.

The posterior extremity possesses a very thick transverse branch (bulb) and is directed upwards at quite a sharp angle. The anterior extremity runs into a sort of beak, which causes less annoyance within the introitus than might be expected. The curvature of the pessary is very serviceable, so that the beak rests well upon the rami of the pubis, without projecting strongly into the introitus.

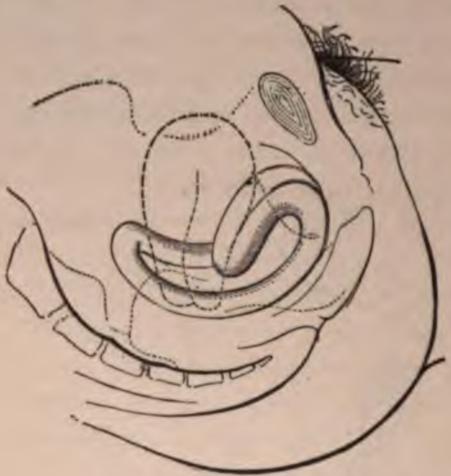

FIG. 62.

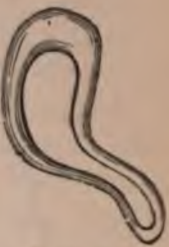

FIG. 62, *a*.

Studley recommends a pessary, similar to Hodge's, whose posterior extremity possesses a second, smaller ring, which rises 12 to 15 mm. above the arms of the larger one. The small ring incloses the cervix (Fig. 63).

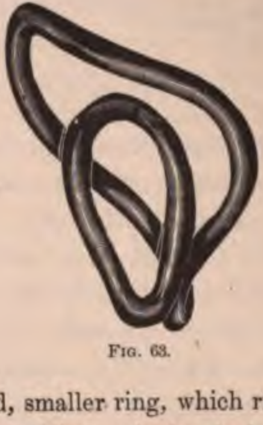

FIG. 63.

The anterior vaginal wall is sometimes very flaccid, or cystocele may be present; and while the tension of the posterior vaginal vault suffices to fix the cervix posteriorly, the anterior vaginal wall pushes down between the branches of the pessary. This drawback may be remedied by using a pessary with thicker arms or curving the anterior branch upwards. If this proves insufficient or is not tolerated, a rubber diaphragm may be inserted between the anterior branches.

Profuse vaginal secretion is especially observed after the use of wire pessaries which are covered with rubber. Cleansing injections, to which an astringent or disinfectant is added, should be ordered once or twice a day.

Pressure necroses and ulcerations demand special attention. The predisposition to these changes varies extremely. We have sometimes seen the vaginal walls thickened around the branches of the instrument and even ulcerated beneath it at the end of a few days, although the pessary was not too large and the tension of the vaginal walls did not appear to be unduly great. In other cases no injurious effects of this character were noticed even after the instrument had been used for years. But symptoms of pressure necrosis occasionally appear without special cause after the instrument has been well tolerated for a long time. We must therefore be extremely careful. Increased secretion, which is tinged with blood, is often an indication. The patient must be warned to consult the physician immediately, if this occurs, or to remove the pessary forthwith. A better plan, though not always practicable, is to make frequent examinations, in order to prevent the occurrence of the lesion.

The instruments are sometimes not tolerated, inasmuch as pains in the back, abdomen, rectum, etc., set in, or pre-existing pains are increased. This may be the result of abnormal nervous irritability in very sensitive women and particularly in virgins. The instrument should then be removed and again inserted at the end of a certain length of time. If the second attempt proves useless, this plan of treatment must be abandoned.

The pains may also be the result of inflammatory conditions. In not a few cases the median portion of Douglas's folds is found thickened, tense and painful, even if the proper instrument has been selected. The pessary must then be removed forthwith, and the ordinary treatment adopted.

In other cases the cause resides in a displaced ovary, which retains its position, even though that of the uterus is normal. Pessaries have been devised whose posterior branch is very thick, like that of Thomas's instrument, in order to act as a sort of cushion and support for the ovary.

The frequent assumption of the knee-chest position has also been recommended. But as a general thing treatment with pessaries must be abandoned, especially if the ovary is adherent.

Unilateral retraction of the sacro-uterine ligament may give rise to pain on account of the pressure of the pessary, and may also cause a restoration of the malposition on account of the deflection of the cervix. Hence the pessary is bent toward the side of the retraction, but not infrequently we must abandon treatment with pessaries. In very sensitive patients, but especially in virgins, even a well-chosen instrument may not be tolerated, inasmuch as it immediately gives rise to extremely disagreeable sensations.

In an elderly woman, in whom a lever pessary had been introduced on account of retroversion with moderate cystocele, a cancer of the vagina was detected. The nodule originated exactly at the point at which the anterior branch pressed the vaginal wall against the descending ramus of the pubis. As primary cancer probably has never been observed in this region, we think that the pressure must be regarded as the exciting cause of the neoplasm.

The lever pessary is indicated in all old retroflexions and retroversions, unless special circumstances contra-indicate its use. Recent displacements, especially if they have developed during and after the puerperal period, should first be treated by other means.

Marked flaccidity of the vagina requires preliminary treatment. If there is rupture of the perineum, or a prolapse of the vagina, an operation must first be performed in some cases. Notable changes in the portio vaginalis (elongation, cervical catarrh, marked erosions), also require preliminary treatment. Among affections of the body of the uterus, large tumors do not permit the application of a pessary. On the other hand small fibromata, congestion and endometritis of the body of the uterus, by no means constitute contra-indications. These conditions, particularly congestive swelling of the uterus, are almost always improved by the insertion of the instrument.

However advantageous the treatment with pessaries may be, so far as regards the relief of many symptoms and sequelæ of displacements, it rarely produces complete recovery. Many attempts have been made to secure for anteversions and anteflexions the favorable results obtained by the use of pessaries in retroversions and retroflexions.

Graily Hewitt employs his so-called cradle pessary, whose form and mode of application are sufficiently explained in Fig. 64 and 65.

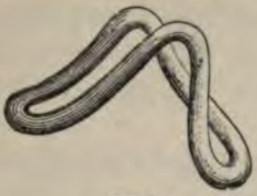

FIG. 64.

Playfair uses a Hodge's pessary to whose posterior branch is fastened a second ring. This is extremely concave superiorly, so that the anterior branch pushes the anterior vaginal vault upward to a marked degree, and thus also pushes the flexed body of the uterus upwards (Fig. 66).

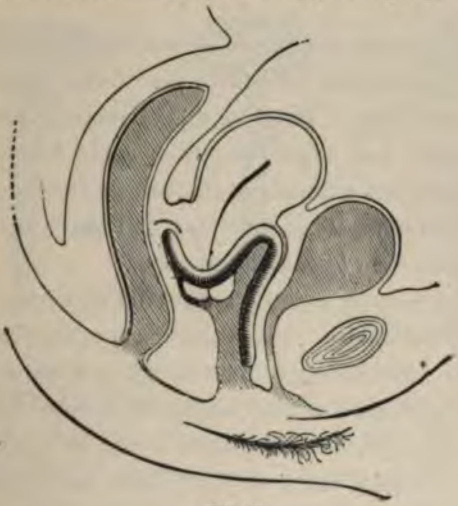

FIG. 65.

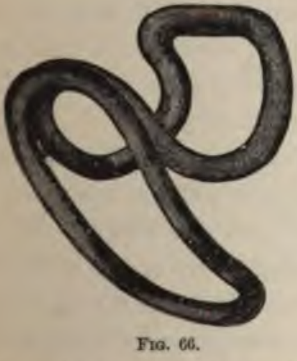

FIG. 66.

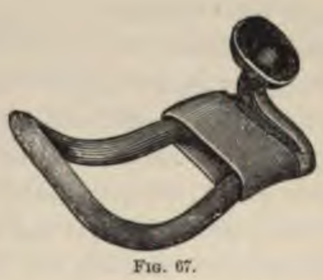

FIG. 67.

Studley applies to the anterior part of a short pesssary (the vagina should not be extended, in order that the anterior vaginal wall may readily stretch) a short rod upon a small cushion, which is intended to hold up the vaginal wall and the body of the uterus (Fig. 67). Peaslee used a sort of cradle pessary. Thomas has also devised several anteflexion pessaries.

Hitherto this plan of treatment of anteversion and anteflexion has not found many adherents.

INTRA-UTERINE PESSARIES.

Like many other therapeutic methods, treatment of uterine flexions by means of pessaries, which are introduced into the cavity of the organ, has had a very changeable fate. Extolled enthusiastically, then entirely discarded, again brought into vogue, and then again fallen into discredit, this plan has nevertheless maintained its position until the present time.

Beigel is a decided advocate of this plan, but there are also numerous opponents, and some even discard it entirely.

The intra-uterine pessary consists essentially of a rod which is introduced into the uterine cavity. Since this rod would either fall out of the womb or penetrate more deeply into its cavity, it receives a so-called supproter. This support has also been sought by means of splitting the rod in two along its long axis, both branches acting as a spring. The pessary maintains the normal shape of the uterus, but its position may remain abnormal. Hence, a pessary which improves the position of the uterus is often employed as a supporter, and the rod is fastened to the latter, either firmly or with a certain degree of mobility. In other cases a pessary or other instrument for improving the position of the uterus is employed in addition to the uterine rod and its supporter.

The simplest apparatus consists of a straight or more or less curved staff of ivory, horn, hard rubber or some more yielding substance, such as the fenestrated end of an elastic catheter or a solid bougie. The staff is solid or hollow, and provided with openings for the escape of secretion. The latter possesses only an imaginary advantage, inasmuch as the canal is soon occluded. Indeed, the stagnant secretion may decompose and set up mischief. The staff is fastened to a button or small disk (Fig. 68, *a*, *b*, *c*). The button should not be too small, in order to prevent its sliding into the cervical canal. This has happened while using Braun's hard-rubber pessaries.

These instruments often suffice in anteflexions, especially those associated with a certain degree of anteversion, and also in those cases in which the vagina is quite resisting, so that the instrument finds a support upon the posterior vaginal wall.

In retroflexions, especially those which are associated with retroversion, and in anteflexions with a flabby vagina, the instrument is apt to fall out unless, as sometimes happens, it is firmly grasped by the contracted and swollen uterine walls. Hence the disk has been made larger, and a Mayer's ring, a tampon or simple rubber ball, has been placed beneath it as a support. Beigel has connected the staff directly with a rubber ball. Schultze passes the staff through the smaller opening of a lever pessary. Wright's spring pessary prevents the escape from the uterine cavity in many cases by the separation of its branches (Fig. 69, A B C D).

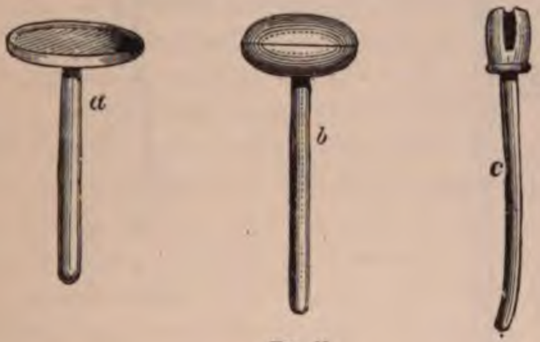

FIG. 68.

Attempts have been made in various ways to give to the uterus, which has been straightened, a normal position, *i. e.* to relieve co-existing anteversion and retroversion. The introduction of tampons of cotton or charpie, in retroversion in front of the supporter, in anteversion behind it, requires frequent changes and is very complicated. In retroversion it appears simpler to introduce a Hodge's pessary or some other instrument which is used in this displacement; the pessary need not be in direct contact with the staff. After the pessary has pushed the cervix backward, the button or disk of the staff is supported upon the posterior vaginal wall. Our object is attained more completely by uniting the staff with the pessary and employing the latter as a supporter. In accordance with this idea was devised E. Martin's dangerous instrument, consisting of a wooden ring, in the middle of which the staff is fastened by a spring and hinge in such a way, that it may incline to one side and may be raised to a right angle, but cannot move towards the other side.

The more recent instruments are modifications of Hodge's pessary. A firm rubber band is stretched across the branches of the ring near one extremity. The staff is fastened to this band by a screw (Studley's pessary, Fig. 71).

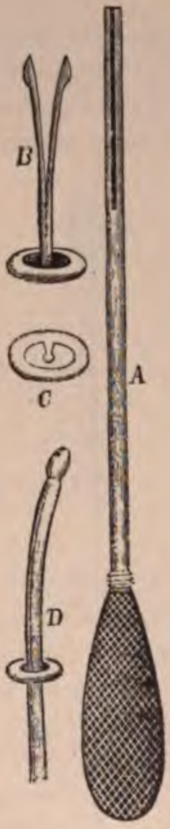

FIG. 69.

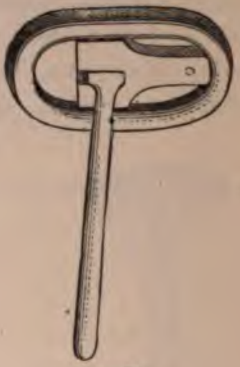

FIG. 70.

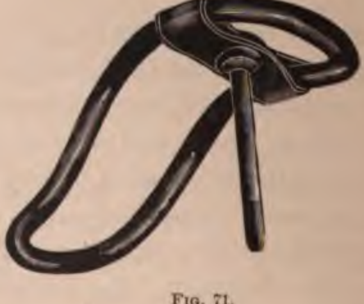

FIG. 71.

The staff of all these instruments should not be too long, in order that its tip may not reach the fundus of the uterus. The length of the uterine cavity should be measured with the sound, and the staff should be 1 to 2 cm. shorter. But it must pass a considerable distance beyond the internal os, since otherwise a flabby uterine body might fall across its tip. The staff should not be so thick that force is requisite to pass it through the cervical canal; its tip must be well rounded. In marked flexions the staff should be somewhat bent, or of such a character as to bend of itself. A pessary or spring regulator may not be too large and must allow the uterus a certain degree of motion.

The instrument is introduced in the following way: Braun's pessary and Wright's spring pessary are provided with a special apparatus for introduction, a sort of sound upon which the staff is situated and from which it can be removed after insertion. Other instruments are applied with the fingers. This is done in lithotomy, lateral and latero-abdominal positions. The index finger is applied to the os, the tip of the staff, whose disk is grasped by the other hand, is carried along the finger to the os and then pushed along. In retroflexions the index finger, placed in the posterior vaginal vault, may somewhat elevate the uterus. In anteflexion combined with anteversion the portio vaginalis may be pushed somewhat forwards. At the same time the button must be pushed strongly upon the posterior vaginal vault towards the sacrum. Obstruction at the internal orifice may be overcome by lateral movements. Winckel recommends, particularly in marked anteflexion, that the sound be introduced, the portio vaginalis pushed towards the symphysis, and the staff then introduced along the sound. The staff may also be introduced to a certain distance alongside the sound, and the former then pushed in further as the latter is withdrawn, inasmuch as there is rarely room for both instruments.

The best and gentlest plan consists in exposing the os, by the aid of Sims's speculum, grasping the anterior lip of the cervix with forceps and drawing gently downwards, and then inserting the staff. If necessary, the sound may be previously introduced, partly for diagnostic purposes, partly to rectify the malposition.

It is more difficult to introduce instruments which are intimately connected with a vaginal pessary. If Simpson's or Martin's so-called "spring regulator" is used in retroflexions or retroversions, the staff, turned backwards, is introduced into the os, the pessary gradually pushed deeper into the vagina, until the staff has entered the uterine cavity, and the entire pessary then turned around. After the rotation of the pessary the staff, which had been turned backwards, only permits of motion anteriorly, and the restoration of the retroversion is no longer possible. In anteflexions the pessary is introduced with the staff turned more or less forwards. But it is often very difficult to introduce the instrument sufficiently far to bring the staff into the canal,by pressing the pessary back along the posterior vaginal wall. The pessary is then turned in another direction, so that the staff can no longer turn forwards, but only backwards. Equally difficult is the introduction of the staffs which are applied to a rubber band fastened between the branches of a lever pessary. We may use a sound which is introduced into the lower perforated part of the staff, as in Studley's intra-uterine pessary. In those cases in which rectification of the position of the uterus becomes necessary after the rectification of its shape, it is best, as a general thing, not to employ apparatus whose parts are firmly united. In addition to the staff we may use a suitable pessary. If necessary this may be provided with a rubber diaphragm which supports the staff or its disk-shaped or button-shaped supporter.

After the application of the instrument the patient must remain in bed for several days, and the physician must satisfy himself by occasional examinations of the proper position of the apparatus. At the same time the bodily temperature should be examined. If it is elevated or pains are present, which are not purely neuralgic and accompany the uterine contractions, but are indicative of an inflammatous condition, the intra-uterine pessary must be removed at once, and the patient treated as if she were suffering from beginning peritonitis. Or if any persistent pains are present, it is best to desist from this plan of treatment. If there is no pain or rise of temperature, the patient is allowed to return gradually to her usual occupations, but must avoid all extremes. Winckel and Olshausen have reported cases in which conception occurred while an intra-uterine pessary was worn. On the other hand a case has been reported in which coitus was followed by peritonitis. Special attention must be paid to the menstrual period. Violent pains set in occasionally at such times and necessitate the removal of the instrument, although it may be well tolerated in the intervals.

Swelling of the cervix and also of the body of the uterus is a quite constant result of the use of the instrument. This is recognized by the turgescence of the lips, and their close apposition to the staff, which is firmly grasped. At the same time there is increased secretion from the mucous membrane. The menses are often premature and are more copious than normal. Metrorrhagia may also appear. This congestive condition often changes at a later period, and we may even notice diminution in the size of the previously enlarged uterus, diminution of the secretion, of the dysmenorrhœa and loss of blood during the menses. Cases have also been reported of disappearance of the concomitant and pressure symptoms, which are produced by the anomaly in the position and shape of the uterus, even of favorable structural changes in the organ, such as hardening of the previously very flabby and soft uterus. Permanent relief of the anomaly even after removal of the pessary has also been reported, either with or without the occurrence of conception.

On the other hand mention is made of numerous cases of subacute perimetritis and parametritis, and even of acute (sometimes fatal) peritonitis, which set in either after the first introduction or after the second one, although the previous one may have produced no notable symptoms. It is a noteworthy fact that, after the instrument has been well tolerated for a long time, bad results sometimes set in without any special exciting cause. Accidents have been reported even in recent times, although more suitable apparatus is now employed.

The following indications are mentioned:

1. *Anterior or Posterior Flexions.*—The question whether the use of an intra-uterine pessary may be beneficial in such conditions is quickly decided in the negative for him who denies every direct influence of the flexion. But there can be no doubt that flexion causes compression of the return vessels, that passive congestion and tissue changes may be produced in this way, and that the escape of secretion and the entrance of semen are interfered with. That this does not happen in every case proves nothing, inasmuch as the changes may be compensated by other favorable conditions. In like manner flexions occasionally give rise to even very considerable nervous disturbances, although the co-existing structural changes, particularly the condensation and retraction of the connective tissue, also play a part in their etiology. The significance of the flexion in such cases is shown by the fact that the neurosis disappears with the rectification of the position, although this does not affect the tissue changes. A means of restoring the normal shape is therefore desirable, and this is true so much the more because we are often unable to relieve the second factor, the structural changes. But unfortunately the

uterine pessary is not devoid of danger, and since it rarely produces a radical cure, we will be but little inclined to run the risk of a not inconsiderable danger for a usually temporary success.

Nevertheless we believe that, if severe symptoms are shown to be the result of the change of shape, a cautious trial of the instrument should be made after all other attempts to remove the causal factors of the disease have proven useless. As a matter of course this does not hold good if the flexion is the result of incurable adhesive processes or developmental anomalies. Those cases also need be considered in which the flexion is maintained by changes in the shape of the organ, after all other causes and complications have been removed. Thus, in anteflexions, after relief of retraction of the sacro-uterine ligaments. A trial may be made in retroflexion if no adhesions are present, and if the uterus still presents a posterior flexion, despite correction of the version by a pessary. Whether a staff shall be inserted in flexions associated with marked flaccidity of the uterine tissue, will be considered in the remarks on the next indication.

2. *Incomplete Development of the Uterus or Atrophy with scanty Menstruation or Amenorrhœa.*—Mechanical treatment has been adopted in infantile uterus or uterus pubescens (Puech), during and after the period of puberty, or in the so-called super-involution after child-bed. This may be done in those cases alone in which the condition is local and not the result of general nutritive disturbances. In the latter event, the general disturbances must first be relieved. To this category belong flexions with great flaccidity and poor nutrition of the uterine walls, such as are found not infrequently in chlorotics. As a general thing, however, the relief of the chlorosis is the main indication, and after this has been effected, there will usually be no further necessity for mechanical treatment.

3. *Stenosis of the Cervix.*—In order to produce permanent dilatation, an intra-uterine pessary may be introduced from the start, or the canal first dilated by means of tents or by operation. Fehling introduces glass staffs, provided with lateral fenestræ, immediately after operation. As a general thing, the pessaries are employed very little for dilatation of the cervical canal. The contra-indications are: recent inflammatory conditions of the uterus and its appendages from adhesions which are not easily stretched, tumors, recent flexions after child-bed with imperfect involu-

tion, endometritis of the body and cervix, erosions, kolpitis, menorrhagia and metrorrhagia.

VAGINAL TAMPONS.

Vaginal tampons are indicated chiefly in hemorrhages. Thus, they are used as palliative measures in menorrhagia and metrorrhagia following sub-involution, uterine congestion, new growths, secondary hemorrhages after operations, such as amputation of the cervix, application of leeches to the portio vaginalis or vagina, and scarification of the portio vaginalis.

Such applications of the tampon will be discussed in subsequent chapters, but we may here remark that, after the more important operations the hemorrhages are usually checked much more effectually and safely in other ways.

Vaginal tampons are applied in flexions and versions in order to maintain the effected reposition, and especially as a preliminary measure, before a pessary is permanently introduced. Bozeman recommends a certain form of tampon, which will be described later in detail, in all peritonitides and parametritides which are associated with flexions and versions.

In kolpitis with severe congestion, desquamation of the epithelium and acid secretion, tampons are introduced in order to prevent the contact of raw surfaces, friction, and adhesions. The same object is sought in injuries, traumatic excoriations, operations for stenosis and atresia of the vagina. Bozeman describes a preliminary treatment, by a special form of tampon, for vesico-vaginal fistula. This measure is especially adapted for narrow vagina, cicatricial bands and retractions. It will be described in the section on urinary fistulæ. After operations on the cervix a tampon is introduced in order to retain the dressing, or to prevent the escape of tents or intra-uterine pessaries, and also to give the uterus a normal position after the pessary has been inserted. The tampon is often employed for the application of medicaments in the form of solutions, ointments and powders. Finally, Schultze employs the tampon as a means of diagnosis in endometritis.

The best material for tampons is ordinary or absorbent cotton. The latter is employed when the tampon is to be thoroughly soaked in a medicated solution or when it is intended to absorb secretions and blood. Its shape varies according to the object to be attained. For example, if the vaginal walls are to be kept asunder, a sort of elongated cushion is made. The tampon is usually spherical or ovoid, and larger or smaller according to the width of the vagina and introitus and the object to be attained. As a general thing it is better to use a greater number of tampons than too large ones, if the latter are introduced with difficulty. They are inserted with the aid of a cylindrical or bivalve speculum, into which the tampon is introduced and then pushed with a pair of forceps beyond the speculum into the vaginal vault; if necessary, the first tampon is followed by a second, third, etc. The vagina may also be tamponed without the aid of a speculum. Two fingers are inserted in the introitus and press down the posterior vaginal wall. The tampons, which should be of small size, are then passed along the fingers.

The application is facilitated by smearing the tampon with fat, oil or vaseline, to which disinfectants may be added, as required.

The tampon may be removed by the physician or patient. The former easily does this with a pair of forceps which are introduced under the guidance of the index finger. Otherwise they can only be removed by means of a thread which is fastened to each tampon. Either each tampon is provided with a separate thread or they are all fastened by a single thread, at a distance of about 15 cm. from one another. If the former plan is adopted, we are apt to pull first upon the higher tampons, while this is obviated by the latter plan.

In uterine hemorrhages our object, as a rule, is merely to fill the vaginal vault. Two to six tampons of the size of a walnut are generally employed. The first one, which is often provided with an astringent fluid or powder, is placed against the os uteri. The others are then introduced in the various parts of the fornix. Excessive distension is to be avoided, since the stretching of the vagina and particularly the separation of the os may even have an injurious effect on the hemorrhage. It is best to leave the lower part of the vagina free. The patients are especially annoyed by distension of this part; they are unable to micturate and experience unpleasant sensations. The tampon should not be retained more than 12 to 24 hours.

In versions and flexions the tampon is pushed into the position of the displaced body, in order to lift it into another direction. The attempt is often abortive, because the tampon is displaced and becomes soft. The tampon is also apt to produce a displacement of the cervix which is unfavorable to the desired rectification.

In order to demonstrate the existence of endometritis a tampon of absorbent cotton should be moistened, according to Schultze, with glycerine, and its surface freely bathed in a 25 per cent solution of tannin and glycerine. This is applied to the os uteri and removed at the end of 24 hours. Normal secretion appears as gelatinous clumps of transparent or slightly cloudy mucus. Pus is distinguished by its consistence, opacity, and yellow or greenish color. The microscopic appearances are decisive.

Bozeman's method in old perimetritis and parametritis, retraction of the ligaments and consequent uterine versions and flexions, appears to us to be important and very worthy of trial. We also observed good effects when the remains of exudation were present and the mobility of the organ was impeded, but versions and flexions were not present. Bozeman recommended his plan particularly in such cases. The favorable results depend partly on the compression, partly on the gradual distension, as a result of which the pelvic organs again become more movable. The improvement in the position and shape of the uterus is also a factor. Bozeman extols his method, particularly when the ovaries are displaced or even adherent.

In posterior versions our chief object is to stretch the vagina in its longitudinal axis and laterally, but not much in the sagittal direction. Therefore specula should be employed which act laterally—for example, Bozeman's or Neugebauer's. In addition the posterior vaginal is slightly distended with air. A tampon of the size of a walnut, which has been somewhat flattened with a pair of forceps, is now shoved into the apex of the posterior fornix; then one or even two more are placed alongside the first one. One will suffice in the sagittal direction. It is astonishing how many tampons can be introduced in this way without annoying the patient, or giving rise to difficulty in micturition or defecation, if the procedure is carried out strictly in accordance with Bozeman's recommendations.

In anteflexion the first tampon is placed in the middle of the anterior vaginal wall, and the vagina must be stretched in the sagittal direction.

Tampons of linen bandages or strips, charpie, and sponge are less serviceable than those of cotton. The introduction of a rubber bag, as is done so frequently in obstetrics, is less practicable, especially if the fornix of the vagina is to be distended as uniformly as possible.

In order to permit the patient to introduce the tampons Sims devised a tampon-placer (Fig. 72) an oval metallic cup, open above, into which the tampon is placed. The hinge, by means of which one half the cup can be separated from the other half, is not absolutely necessary. The cup is fastened to a metal tube, in which are a rod and piston. When the cup reaches the vaginal vault, the piston is driven home and the tampon pushed out.

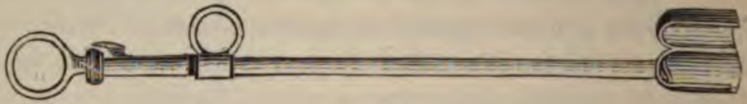

FIG. 72.

THE APPLICATION OF THE ACTUAL CAUTERY AND STRONG CAUSTICS.

The actual cautery is applied particularly to the cervix, especially the os and surrounding parts, but also higher up in the cervical canal. In rarer cases it is applied to the vagina and external genitals or to the interior of the body of the uterus. It is employed in epithelial proliferations of the portio vaginalis, glandular and papillary hyperplasia (erosions) with co-incident hyperplastic processes in the deeper portions of the cervical wall. It is also used particularly in soft swelling of the portio vaginalis, with ectropium of the uterus, such as remain behind in subinvolution of the uterus after delivery. If the erosion is situated on a hard base and the lips are very firm and resistant, less is to be expected from the actual cautery, although even then it has been employed by some in a less intense and fleeting way as a sort of stimulant.

It has also been recommended in recent times, especially in the shape of ignipuncture, in simple hyperplasia of the vaginal portion without so-called erosion. It cannot be denied that rapid resolution usually follows in the softer forms, which are left over after child-bed, but this may also be effected in other ways.

In obstinate cervical catarrhs with loosening of the mucous membrane and profuse secretion the actual cautery is an admirable remedy.

It is extensively used in cancer of the cervix as soon as it ulcerates. The object desired is to produce rapid destruction of the gradually degenerating portions of the tumor, and thus to keep the base of the ulcer cleaner for a longer or shorter time, to diminish the foul odor, the ichorous discharge, and the hemorrhage from the fungous proliferations. In this way the patient is spared the tedious gangrene and loss of blood, and a protracted period of comparatively good health secured. In many cases it is best to remove the proliferating fungous masses and the thicker necrotic parts with the curette before applying the cautery. It is evident from these remarks that this measure is purely palliative in such cases. It should not be employed, therefore, before the destruction of the new growth has progressed considerably, or if there is merely a moderate ulceration, even though the cervix is considerably infiltrated. The cautery would then produce very extensive and rapid ulceration, which perhaps would not have occurred until a later period. Moreover more radical treatment is often indicated under such conditions. Even in extensive ulceration it is best to destroy only those parts which are about to undergo degeneration, and especially the fungous proliferations, but not to penetrate too deeply into the healthy or even the swollen and infiltrated tissues. If the cautery is applied too deeply, too frequently or at too high a temperature, not alone is the previously mentioned bad effect produced, but normal vessels are apt to be cauterized and thus other hæmostatics become necessary. The measure is contra-indicated when the ulceration has advanced too far towards the peritoneum or bladder, since the danger then arises of opening into the abdominal cavity, bladder or rectum.

The actual cautery has also been employed in cancer of the vagina and external genitals for the same purposes as in cancer of the neck of the uterus.

It is also used in those cases in which, after extirpation of the cancer with the knife and scissors, we desire to destroy the remains of the new growth or to check hemorrhage continuing after the operation. Nothing can be said against the attempt to secure the former object in this manner if we think it is unattended with danger, and, of course, it is very satisfactory if the second object, the checking of the hemorrhage, is also attained in this way. But we possess more reliable hæmostatic remedies in such cases than the cautery.

The actual cautery has been applied to the body of the uterus merely as an experiment. Speigelberg applied it to the inner surface of the corpus uteri in hemorrhages, but seems to have abandoned the method.

A contra-indication to its employment is the existence of acute inflammatory conditions near the uterus, or of cystitis.

The application of the actual cautery to the cervix is often followed by a not inconsiderable swelling, which also extends to adjacent parts and thus may give rise to dysuria and ischimia. The exfoliation of the eschar is usually slow, unless very soft parts of a tumor are alone manipulated. At first it is accompanied by some discharge of blood, occasionally by a considerable hemorrhage, and by a serous fluid, resembling meat broth, containing black necrotic particles. The discharge afterwards becomes purulent. Complete healing, such as occurs in non-malignant conditions, requires 4 to 6 weeks. Injurious effects are rarely observed, and notable irritative and inflammatory conditions are very exceptional. But it is always best to keep the patient in bed for 3 to 5 days, if the cautery has been applied vigorously. Stenosis and even atresia of the os and cervix uteri have been described among the later sequelæ. Hence the process of healing must be watched if the cautery has been applied deeply in the canal or vigorously to the immediate neighborhood of the os uteri. But even very active applications rarely produce deep destruction of the mucous membrane. The latter remains entirely or partly intact, and after healing has a normal appearance.

In order to employ the actual cautery, a chafing-dish and bellows or a good alcohol lamp with a stand and a sufficient number of variously shaped irons may be recommended as the simplest and most practicable apparatus. They posssess the one disadvantage of frightening the patient. Irons with moderately large, round tips and others with pointed, ovoid, narrow tips, for the cervical canal (Fig. 73) are amply sufficient. The protection of the vaginal walls and external genitalia is an importa point. This is best secured by the introduction of a cylindrical wood speculum, though the latter often prevents sufficient exposure of t diseased surface, particularly in marked hypertrophy of the anterior and in cancers. We must then use a hard rubber Sims speculum and wooden or hard-rubber depressor. If there is marked secretion from t diseased surface it must first be dried with a sponge or cotton. Af

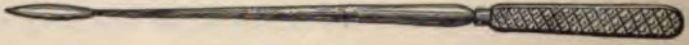

FIG. 73.

the application the cylindrical speculum may be filled with cold water, or, if Sims's speculum has been used, a stream of water is poured upon the portio vaginalis under feeble pressure. Gusserow recommends Matthieu's double-walled speculum; a tube, which is connected with a vessel filled with ice-water, leads into the space between the walls, and another is inserted for the escape of the water.

The application of galvanocaustic apparatus is too complicated to be used extensively. Paquelin's thermocautery, on the other hand, is very widely used, because it is very convenient, and, unlike galvanocaustic apparatus, is not apt to get out of order. The platinum tips have a needle, club, round, coin or knife shape. Its more circumscribed action should be regarded as an advantage rather than a disadvantage. But the tip connection is apt to become covered in a little while with a layer of half burned tissue, which prevents or at least interferes with the further action. In the majority of cases, however, the thermocautery proves sufficient.

The use of strong chemical caustics has passed recently into the background when compared with the actual cautery, with the exception of the nitric acid applications previously described. Caustic potash or a combination of potash 5 parts, and lime 4 parts, was much employed formerly for the cauterization of the portio vaginalis in hyperplasia, ectropium, etc. It is much more difficult to limit its action, and the protective measures are occasionally insufficient to prevent the liquefied caustic from injuring surrounding parts. The portio vaginalis is exposed with a cylindrical speculum, a semi-circle of cotton moistened with vinegar placed between the rim of the speculum and the lower lip of the cervix, the stick of caustic grasped in a porte-caustique or pair of forceps, and then painted over the parts. After the application weak vinegar is poured into the speculum.

Strong fluid caustics, particularly nitric, chromic and sulphuric acids, are much more frequently employed at the present time. The adjacent parts are protected with cotton or linen. A glass rod or brush is used for the application, but care must be taken that too much acid does not cling to the brush. After the application the remainder of the caustic is absorbed by cotton or a sponge, and, if necessary, an alkaline carbonate is added.

In cancer of the cervix, Routh recommended bromalcohol (1 part bromine, 10 parts alcohol). A piece of cloth, dipped in this solution, is applied to the ulcerated surface or is pushed into the cervix, if the ulceration extends high up. The cloth is retained by tampons dipped in a strong solution of bicarbonate of soda, and the latter protect surrounding parts from the action of the caustic. The dressing is removed in 24 to 48 hours. A sponge dipped in a solution of bicarbonate of soda is used to guard the respiratory organs of the physician against the fumes of the bromine. Schroeder also recommends this plan particularly for the removal of the remains of the tumor after a bloody operation and the application of the actual cautery. This measure requires caution. If the ulceration extends deeply, the action of the caustic may extend too far towards the peritoneum or bladder. Fatal peritonitis resulted in one instance.

LOCAL ABSTRACTION OF BLOOD.

At one time physicians applied leeches or cups to the painful parts in any painful affection, which appeared to be of an inflammatory character. Gynecologists also adopted the views then in vogue, and at one time the application of leeches to the portio vaginalis constituted the first and last resort in the treatment of sexual diseases. But the field of usefulness of local venesections has been greatly circumscribed. This is owing to the fear of removing blood from a sick individual who is apparently or really anæmic, or, at least, presents symptoms of a certain degree of weakness. But if the abstraction of blood had produced considerable temporary or permanent improvement or cure of the morbid condition, the advantages attending this measure would still have been greater than its disadvantages.

The chief reason for the abandonment of venesection is the conviction that it produced but little effect. Moreover, we possess good substitutes for it in the shape of ice-bags, compresses, irrigations, the proper administration of opiates, suitable positions, etc.

Local abstractions of blood are employed chiefly to alleviate the pains associated with marked uterine congestion, the annoying downward pressure, the pains in the back, etc. They are indicated when the symptoms set in after the end of the greater half of the menstrual interval, or when the pains continue after scanty menstruation, in tenderness of the entire uterus or of parts of the organ, in pain on motion, tenderness of the groins or ovaries, congestion or lividity of the portio vaginalis, turgescence and intense redness of the cervical mucous membrane.

Local abstraction of blood within the genitals is not to be recommended in acute inflammatory conditions of the appendages of the uterus and the peritoneum.

Venesection of the anterior vaginal wall has been advised when there is great tenderness in cystitis and catarrh of the bladder.

Local abstraction of blood from the portio vaginalis is effected by means of leeches or scarifications, after exposure of the parts by means of a cylindrical speculum. The entrance of the leeches into the vagina is prevented by pressing the rim of the speculum against the vagina. A still more disagreeable accident is the passage of a leech into the uterus, as it may give rise to very violent uterine colic. Scanzoni recommends that only the anterior lip of the cervix be brought into the lumen of the speculum. But this only excludes the leeches entirely from other parts in cases of considerable hypertrophy and favorable shape of the lips of the cervix. Weber advises that a thread be drawn through the tail of the leech. The external os may sometimes be plugged by a small wad of charpie or cotton. But the main feature consists in paying careful attention until the leeches have taken a firm hold. They may be prevented from wandering by means of a sharply serrated pair of forceps. Three or four leeches will usually secure an after-hemorrhage of about 80 gm. This need not be checked until it exceeds 100 gm. in amount. If the vagina is plugged after the application of the leeches, an irritation is produced which is apt to destroy the good effects of the bleeding. If the hemorrhage is too severe, we may apply a single wad of cotton to the bleeding spot, and, if this proves insufficient the part is enclosed in a suture.

Among the unpleasant sequelæ which occasionally follow the application of the leeches, is severe uterine colic. This is best relieved by an enema containing opium. Scanzoni also mentions violent reflex symptoms, spasmodic attacks, vomiting, delirium—symptoms which occur occasionally after a simple examination in hysterical individuals. The appearance of an urticaria-like eruption has also been mentioned. Notable permanent sequelæ have not been observed.

Scarification forms the second method of local abstraction of blood from the portio vaginalis. Incisions into the lips of the cervix are made with a long-handled, curved knife. Considerable hemorrhage occurs occasionally if the parts are congested or a large vein is entered. But very numerous or deep incisions must usually be made in order to discharge a sufficient amount of blood. If the incisions are made too deep, as is apt to occur on account of the long duration of the procedure, we can no more guard against occasional excessive after-bleeding than in the case of application of leeches. Such deep incisions occasionally heal very slowly. Kristeller recommends acupuncture for the abstraction of blood. The after-bleeding is sometimes very marked.

The application of leeches to the perineum and anus is employed in virgins as a substitute in those cases in which accidents have occurred after previous applications of leeches to the cervix, and in individuals in whom, for some reason, the introduction of a speculum and the exposure of the parts are to be avoided. We must warn against the application of too many leeches to the anus, inasmuch as severe hemorrhage in this locality is not infrequent. Three leeches usually suffice, more rarely 5 or 6 are required.

Every patient, who is subjected to these methods of treatment, should stay in bed about 24 hours, in order that the advantage derived from the depletion of the vessels should not be counteracted by the erect position and by motion.

The application of cups to the uterus has met with very little favor.

ABDOMINAL BANDAGES.

Abdominal bandages may be either complete or partial. Those which pass around the entire abdomen may be applied in the following manner: The distance from the symphysis to the ensiform cartilage is measured, and a piece of linen or cotton is cut of this width. Its length should be 10 to 20 cm. greater than the circumference of the abdomen and the cotton bandage, which will now be described. The abdomen is covered in front and on the sides with a thick uniform layer of cotton, but if, as so often happens, the hips are much broader than the waist, additional layers of cotton are applied to the loins and region of the false ribs, in order to secure an uniform application of the bandage. If greater pressure is to be brought to bear on a certain spot, this part is covered with an extra layer of cotton. The ends of the bandage, which is passed under the back, are carried across one another upon the abdomen and firmly pinned together (dry pack).

In applying a wet pack two or three cloths of the size mentioned above are dipped in water, wrung out, placed smoothly upon one another and then upon thin rubber cloth. The whole is then shoved under the loins and the cloths are successively drawn round the abdomen; finally the rubber cloth is used in the same way.

Such dry and wet packs afford a certain support to the abdominal walls and the movements of the latter are diminished. The pressure within the abdominal cavity is increased, and hence there is less marked variation in pressure as the result of external factors, such as passive or active bodily movements, especially of the trunk, the assumption of a position on the other side of the body, the movements of respiration, coughing, sneezing, laughing, vomiting, etc. Even hemorrhages into the abdominal cavity may be prevented or moderated by these packs. Their protection appears particularly important in irritative conditions, inflammatory processes in the abdominal cavity, peritoneum and adjacent organs.

The effects of the uniform compression exerted by these packs are not to be underestimated. Since we have used them from the start in circumscribed and diffuse peritonitis, we have not observed such marked tympanitic distension as formerly. It might be supposed that, instead of the distension of the anterior abdominal wall, the diaphragm would be pushed higher and the respiratory difficulty would increase, but this is not true. The pack is very agreeable to the large majority of the patients.

The support feels comfortable, and the pains produced by respiration and motion are considerably diminished. But the application of the bandage demands extreme care, and only a very experienced nurse should be permitted to apply it. Above all we must endeavor to produce uniform compression. Excessive pressure may give rise to thromboses by interfering with the circulation in the pelvis and lower limbs. Care must also be taken that the bandage does not come down too low and exercise pressure on the saphenous vein. In this way the otherwise remarkably soothing effect of the bandage may be converted into the opposite, especially after operations which have been attended with great diminution in the size of the abdominal cavity, such as ovariotomy or puncture of ascites. This is also true of the bandages applied during childbed. Wet packs have an additional effect. The abdominal walls are soon surrounded by a cataplasm, the skin becomes softened and congested. If used for a long time, papules and vesicles will make their appearance. These packs are very valuable in acute and chronic inflammatory conditions of the abdominal and pelvic organs. If the patients are not thoroughly warm and experience disagreeable sensations from the wet cold, the cloths should be wrung out thoroughly, the entire pack covered with flannel, warming-pans applied to the sides and the pack seldom changed. It should not be applied for the first time until the patient has been in bed about half an hour and is thoroughly warmed. If the patient is too warm, the cloths are not wrung so thoroughly and are changed more frequently, and an ice-bag may even be applied to a special painful spot. The pack may be moistened after removing it entirely, but this is not advisable in acute processes, attended with great tenderness. In such cases the cloths are separated upon the anterior abdominal wall and moistened with a sponge.

These packs are chiefly of service when the patient lies quietly in bed.

Some individuals require support of the abdominal muscles in the erect position, either because the weight to be carried (pregnant uterus, tumor, etc,) is too great or because the abdominal muscles are poorly nourished, flabby, and insufficient. Specially prepared bandages are required in such cases. They sometimes extend from the symphysis to the umbilicus, sometimes only over a part of this region. Towards the symphysis they are slightly caudate in shape. They are made of linen, wool or flannel; this is woven with rubber cloth or the latter is used only in places. Some bandages are made entirely of rubber cloth. In order to secure the necessary stiffness whalebone bands are often introduced lengthwise, but these not infrequently cause disagreeable partial pressure. Many bandages are fastened by an ordinary elastic belt in such a way that the ends of the belt are tightened by means of a buckle in the region of the spinal column (Fig. 74). In others the ends of the belt are crossed at the spine and are then fastened by a buckle over the symphysis. Thigh straps are almost always required.

An important feature is the band *a* (Fig 74), which runs transversely above the symphysis across the lower part of the abdomen, and which is modified in various ways and may be provided with auxiliary apparatus.

Thus, a pad may be inserted above the symphysis; or upon that part of the bandage which is situated over the symphysis is placed a weak spring, in whose covering are sewed the buttons used for fastening the band *a*

(Fig. 75 *b*). Rubber cushions filled with air, cotton or hair-pads are used in abdominal hernia and movable kidneys. Slight thickening over the parts which are to be subjected to increased pressure often suffices. In herniæ and yielding portions of the abdominal walls, a pad which compresses the abdomen too forcibly and acts only upon the yielding part, is apt to exercise injurious effects. In marked weakness of the back, pains in the back and sacro-lumbar neuralgia, pads are placed in the lumbar region, as shown in Fig. 76. They have very good effects in some

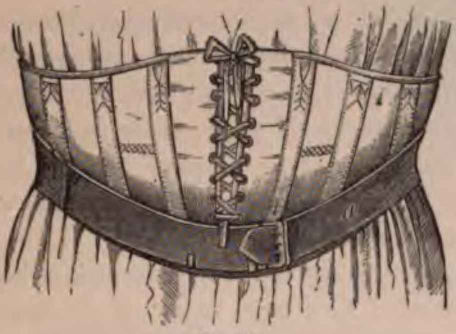

FIG. 74.

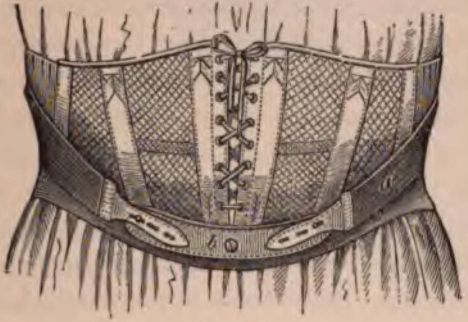

FIG. 75.

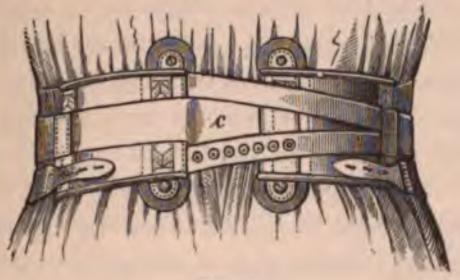

FIG. 76.

cases, but additional support to the spine may be necessary in order to relieve the pains produced by over-exertion of the extensors of the back, in paralysis of the abdominal walls or abdominal tumors. Thus good results have been obtained from an abdominal bandage with a spring around the hips (as in a truss), and to which a sort of corset is added. Even crutch-like arm supports, which rest upon the bandage, may be rendered necessary. The patients must be informed that the bandages can only be tested by wearing them, and that slight inconveniences therefrom often necessitate modifications here and there.

The bandages are especially suited to those cases in which the abdomen is very much distended by a large tumor or the pregnant uterus, and great traction upon the abdominal walls is thus produced. They may be employed at an early period if the abdominal walls have suffered from previous pregnancies.

In simple insufficiency of the abdominal walls, such as is observed after pregnancy, tumors and ascites, the support of a bandage is rendered so much more necessary if there is a considerable deposit of fat in the abdominal walls, omentum and mesentery. The bandage then prevents excessive diminution of abdominal pressure, which may give rise to considerable (especially venous) congestion. In addition, it prevents traction on the nerves of the abdominal walls and the suspensory ligaments of the viscera, which may give rise to severe neuralgic pains and even to other concomitant symptoms. It also tends to prevent dilatation of the stomach, meteorism and constipation. A certain weakness of the abdominal muscles is found not infrequently in virgins and nulliparæ, especially if they have suffered from protracted chlorosis. Here the muscular tonus can usually be restored by radical treatment, by relieving the general condition, exercise, electricity, etc. Nevertheless it will be necessary to use a bandage for a certain length of time as a palliative measure.

Insufficiency of the abdominal walls is often associated with mobility of certain abdominal viscera, such as the kidneys and uterus. In such cases the bandage must be provided with pads, or, if the pelvic viscera are affected, pessaries must be introduced, or even operative interference adopted. I may here mention that, in retroversions and prolapse of the uterus and vagina, the abdominal bandage may become very necessary in order to maintain a sufficiently high intravaginal pressure. But if the vaginal sphincter apparatus is insufficient, the latter must first be restored by operation.

Extensive herniæ in the linea alba are usually, though not always, associated with general insufficiency of the abdominal walls. The muscles may even be powerful in such cases, as is sometimes observed after laparotomy. Small abdominal herniæ are also observed occasionally when the muscles are intact. The pains are then often greater, because the traction and tension of the small section of the walls are relatively greater, and in addition there is also tension of the parts which immediately surround the hernial opening. We have seen the adjacent muscles in a state of contracture-like tension. In such cases the bandage must contain special pads, which should always be larger than the opening and not too thick.

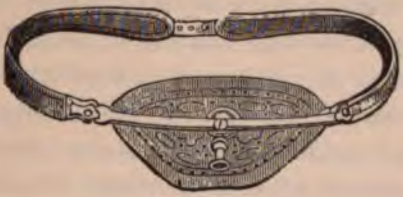

FIG. 77.

Apparatus which exercise isolated pressure on the hypogastric region—the so-called, *ceintures hypogastriques*—were formerly very much in vogue (Fig. 77). These consist of a metallic disk padded upon the side next to the abdominal walls, usually with hair, covered with leather. This cushion is situated above the symphysis and is fastened by a belt with a metallic spring, passing around the hips below the crests of the ilium. By means of a screw the pad may be placed at various angles to the belt, *i.e.* to the abdominal walls, so that the pressure may be exercised more from above downwards or vice versa, according as the lower border of the pad is pushed more or less deeply into the abdominal walls. It is said that these bandages, by their pressure backwards and upwards, antagonize to a certain extent the weight of the viscera, which would otherwise be brought to bear upon the pelvic organs, especially the uterus.

ARTIFICIAL IMPREGNATION.

The term artificial impregnation is applied to the introduction of the semen into the uterus by means of instruments, but the indication for such a procedure will be very rarely presented. Careful investigations have shown that in a large percentage of sterile marriages the male is at fault. The semen contains no spermatozoa or imperfectly developed ones, either as the result of developmental anomalies (such as incomplete descent of the testicles) or of disease. The formation of semen is especially apt to be interfered with after inflammations of the testicles, gonorrhœa and syphilis. The vis cœundi of the male may also be insufficient, and thus be the cause of sterility.

In the female various anomalies may act as the cause of sterility. The complete performance of coitus may be rendered impossible by hyperæsthesia of the vulva, vaginismus, closed or rigid hymen, tumors, etc. In very sensitive women the semen is discharged immediately after coitus by reflex movements of the vaginal muscular coat or by abdominal pressure. Changes in the shape and size of the portio vaginalis, stenosis of the external orifice or cervical canal, angular flexions of the canal, more rarely of the body of the uterus, may prevent the entrance of semen. Anomalies in the position of the cervix may also interpose obstacles. The tip of the glans penis may not come in contact with the external os during coitus, but passes into a sort of blind sack in the vagina. This is formed, in retroversions by the posterior fornix, in anteversions by the anterior fornix, and in lateroversions, by that portion of the vagina opposite to the direction of the cervix.

An important factor appears to reside in the fact that the vaginal secretion, which is dangerous to the life of the spermatozoa, may acquire this property in a still higher degree, and that the secretion of the cervix and body of the uterus may also become deleterious to the spermatozoa. Finally, numerous anomalies of the tubes, ovaries and surrounding parts act as frequent causes of sterility. The ovum, even if it is properly developed, does not find its way into the uterus, because the ovaries are imbedded in masses of exudation, or on account of adhesion of the abdominal end of the tubes, flexion or catarrh of the tubes, etc.

Some of the anomalies which give rise to sterility, particularly those of the ovaries and tubes, are rarely or not at all amenable to treatment. Unfortunately such cases seem to form a large part of the whole number. We have very often been able to demonstrate such changes, since we have adopted the plan of making careful examinations, and, if necessary, administering an anæsthetic to every patient who consults us concerning sterility.

Other causal conditions may be relieved in part, or if this is impossible, their effects may be combated, as, for example, in the case of pathological conditions near the introitus, which interfere with sexual intercourse. Anomalies in the shape and size of the cervix, such as elongation and conicity, or narrowness of the os, are relieved by operative interference. Stenoses of the cervix higher up may be remedied by dilatation, and even in flexion-stenoses this plan, or the prolonged application of an intra-uterine pessary, occasionally secures relief. At least, it may make the conditions temporarily favorable to conception. In retroversion with the formation of a blind sac in the posterior vaginal vault, the patient, according to Pajot, should be constipated for several days before coitus, in ante-versions the urine should be retained for a long time, and in latero-versions she should lie, during coitus, upon the side towards which the cervix is directed. Suitable pessaries may, perhaps, secure relief. Certain empirical measures, such as coitus in the knee-elbow or some similar position may be occasionally successful, especially in changes in the shape and position of the uterus. Finally, we may attempt to remove the abnormal secretion of the vagina and cervix by appropriate remedies.

Thus, little remains for artificial impregnation. Perhaps the chief indication would be furnished by stenoses, especially flexion-stenoses in the upper part of the cervical canal. Haussmann recommends it if living spermatozoa enter the lower part of the cervical canal, but are unable to pass the internal orifice. He even recommends that the attempt be made before the rectification of the flexion. In this case we have to deal simply with the transportation of the semen beyond a portion of the cervical canal. In anomalies in which the semen does not enter the cervix, as in stenosis of the external os, anomalies in the shape and size of the portio vaginalis, changes in its position and direction, the indication is only presented when other measures have been adopted without result, or when they do not promise success. This is also true of a specially deleterious constitution of the secretion of the cervical mucous membrane. The semen must then be conveyed throughout the entire cervical canal. The semen which has been discharged into the vagina during coitus may not be employed, since it often suffers injury after a little while.

The indications for artificial impregnation are, therefore, very limited. Moreover, every physician will probably experience a feeling of disgust at being concerned in such procedures. But, on the other hand, there are motives which should make us forget this side of the case. The happiness of marriage often depends upon the progeny, and those who seek our aid are the very ones who would be able to educate the child into a useful member of society.

A much more important feature is the extreme doubtfulness of a successful result. If we adopt the above-mentioned indications, it is still doubtful, in the individual case, whether other causes of sterility may not be present. But apart from this, the question also arises whether the patient possesses the ability to carry the pregnancy through to its termination. This doubt is frequently justifiable, since the anomalies mentioned often include various changes which will limit such ability.

The results of artificial impregnation have been exceedingly poor, so far as reported by trustworthy observers, and Sims, who has probably done most in this direction, reports only a single successful case. But hitherto the operation has been performed only in very complicated cases, after all other methods had been employed without avail. Haussmann's discovery of the pernicious, and often very rapid deleterious influence of the vaginal mucus on the spermatozoa, and of the bad effects of mechanical manipulations upon them, partly explains the lack of success. Even the transfer of the semen to a syringe injures the spermatozoa, so that, for example, the head may become separated from the tail. The technique of artificial impregnation varies. Sims used a glass syringe which was carefully kept at the temperature of the blood. Soon after coitus, he exposed the cervix in the latero-abdominal position, sucked the semen within the vagina into the syringe, and then inserted the tip of the latter 3-4 cm. into the cervical canal. The piston was moved by a screw in order that the amount injected could be measured more accurately. In this way three or four drops of semen were injected into the uterine cavity. Sims thinks that this amount was too large, and that ½ to 1 drop will suffice. Haussmann merely speaks of the transportation of semen (which is already situated in the lower part of the cervix) into the uterine cavity, across a stenosis or flexion of the upper part of the cervical canal. He recommends a Braün's syringe provided with a flexible canula, or a special instrument, known as the spermatophore. This is a flexible strong sound, with two short, rounded transverse branches, whose object it is to convey the mucus of the cervical canal and the spermatozoa contained in it, into the cavity of the uterus. According to this writer, the employment of the semen which has been deposited in the vagina is absurd.

The manipulation is best performed soon after the cessation of menstruation. If the semen is deposited in the lower part of the cervical canal, it is best to follow Haussmann's recommendation. If another mode of artificial impregnation is adopted, the husband must secure fresh semen. Courty allows him to use a condom into which the penis is not inserted completely; a small blind sac is thus left, into which the semen is deposited.

We must not forget to mention that annoying and even dangerous sequelæ, such as parametritis and perimetritis, have followed the injection. Whether this is the result of imperfect disinfection or is owing to the fact that the semen, being in a condition of intense molecular movement, has a special tendency to decomposition, cannot be determined from the observations. Perhaps the slight traumatism connected with the manipulation also plays a part in these accidents.

SUB-MUCOUS AND INTRA-PARIETAL INJECTIONS.

Injections into the sub-mucous tissue of the vagina, or the wall of the cervix, with a Pravaz or some similar syringe, have been employed for various purposes. These included resolution of simple hypertrophy of the portio vaginalis, of the entire cervix and of the body of the uterus. Attention was directed, at the same time, to the hemorrhages associated with such conditions, so that the remedy (ergotin)was selected on account of this prominent symptom. After Hildebrandt had employed subcutaneous injections of ergotin in fibromata, it was thought that the remedy would act more efficiently if introduced directly into the diseased organ. Tincture of iodine was also injected into the uterine walls or into the tumor itself. The attempt was also made to produce sequestration and exfoliation of malignant tumors, by the injection of caustic fluids into the base of the new growths.

We have attempted, by means of injections of tincture of iodine, to cause absorption of parametritic and perimetritic exudations, of rigid thickened ligaments, and in ovaries which were compressed by firm masses of exudation.

Finally, injections of narcotics, such as morphine and atropine, have been used to relieve a definite symptom, *viz.*, pain.

The cases hitherto reported are by no means sufficient to enable us to formulate definite indications for the procedure. In chronic uterine congestions as much or even more may be effected by other means. The results in fibromata are not sufficiently good to justify us in recommending it very highly. But there can be no objection to making the experiment, if other methods of treatment are unavailing, and we do not decide upon active operative interference. Schuecking injected Fowler's solution successfully in subinvolution of the uterus associated with relaxation of the ligaments or with flexions and erosions, and tincture of iodine in erosions and glandular hyperplasia of the cervix. In parametritic and perimetritic hard, callous nodules of long standing, all remedies are often useless, and the symptoms may be so extremely severe that even a doubtful plan appears justifiable. In cancer of the uterus, operative interference of another kind will generally be selected. Nevertheless, experiments with caustic injections appear to be entirely justifiable. We will probably be able to penetrate more deeply with these than with the knife or actual cautery.

The injections are made with an ordinary Pravaz syringe, or with one which is provided with a long canula. It is best to expose the portio vaginalis with a Sims speculum, and to fix it with a tenaculum. The injection is made 0.5 to 1.0 cm. deep along the long axis of the cervix. It not infrequently bleeds considerably. In order to prevent hemorrhage, and the escape of the injected fluid, the canula is retained in position for some time, and a tampon is rapidly applied after its withdrawal. This need not be apprehended when caustic fluids are injected. The amount of fluid injected should not exceed 5 to 10 drops, as resistance is apt to be offered by the firm tissue of the cervix. Hence the solution should be as concentrated as possible, or several injections should be made.

Guichard recently reported a case of cauliflower growth of the cervix which was treated successfully with parenchymatous injections of chloride of zinc (1 to 5). No relapse had occurred at the end of a year. W. Williams used injections of bromalcohol (1 to 5) in epithelioma of the cervix.

Collins injected ergotin in subinvolution and chronic metritis. J. M. Bennet injected a solution of potass. iodide, gr. x., potass. bromide, gr. x., tinct. iodine ʒ ss., aq. distil. ʒ iss. in chronic cervical metritis ; 4 to 5 injections were made each time. More than three sittings were rarely necessary.

Delore injected a concentrated solution of ergotin (1 to 2) in fibromata ; gr. ij-x ergotin were injected each time. The secondary symptoms were often very violent—chills, tremor, drowsiness, herpes labialis, bilious vomiting, diarrhœa, pains in the tumor, loins, thighs, joints and head. Abscesses formed in two cases, in one in the anterior lip of the cervix, in the other above the umbilicus. In the latter case the tumor had been penetrated through the abdominal walls; complete resolution was never obtained. Some of the tumors became smaller, and ceased to grow. On the other hand the hemorrhages often ceased.

MASSAGE.

In gynecology, massage has been chiefly employed by the laity, in combination with the Swedish movement cure.

This method of treatment was intended for two purposes. The first was the improvement of the general nutrition of the body. Gymnastics, with semi-active and passive movements, were chiefly employed for this purpose. Massage proper is also used for the same purpose. It is assumed that the gymnastics, by means of certain movements which are restricted to individual parts of the body, cause an increased supply of blood to these parts. Hence the production of local changes was also looked for.

The main object of massage proper is to act directly upon the diseased parts or their surroundings. The procedures vary, and it is evident that, in part, they cannot be utilized in gynecology or only to a very limited extent. Stroking (effleurage), which, either alone or in combination with other methods, produces such valuable results, can be very little used upon the uterus and surrounding parts under ordinary conditions. Centripetal stroking may sometimes be performed in large abdominal tumors. The so-called tapping (*tapotement*) of individual parts of the body, and which is said to act particularly through the medium of the nervous system, may be performed, though only partially, upon the abdomen and external genitals, but its physiological and therapeutic effects are so obscure, that it seems to us to possess little value. Kneading (*petrisssage*) and so-called traction-pressure, seem to us to be especially adapted for gynecological therapeutics.

The best results have been obtained in subinvolution of the uterus, and the resulting hypertrophies, in old pelvic exudations, cicatrices and retractions of the ligaments and the resulting changes in the position of the uterus. As a general thing, massage is not employed until the ordinary remedies have proved ineffectual. On account of the slight experience at our command, it is best, for the present, to maintain this standpoint. An exception may be made in the case of subinvolution of the uterus. I believe that, if the contra-indications be taken into consideration, it is the best means of producing rapid involution of the uterus, and I have begun this plan as early as the fifth and eighth days of child-bed.

The following is the technique:

If the uterus is very large, and extends above the symphysis, an attempt is made, with the fingers of one hand, to reach its posterior surface from above or from the sides, in order to steady the organ. At the same time the fossæ of the ilii, the rami of the pubis and the lumbar vertebræ, may also be employed as points of fixation. The fingers then execute stroking, pressing, rubbing movements.

As a general thing, combined manipulations are adopted. The finger inserted into the vagina, more rarely the rectum, fixes the uterus, while the other hand manipulates (through the abdominal walls) the different parts of the uterus in a definite order; pressing, more rarely stroking movements, are employed.

Traction-pressure is exercised either upon the uterus itself or upon tense ligaments. In the former event the finger in the vagina lifts the uterus upwards, or pushes the cervix forwards or backwards. In the latter the resisting parts themselves are moved with the finger in different directions.

The massage cure must generally be carried on for several months. According to Prochownik it must be employed almost every day if it is to prove successful, but such a plan will be followed by decided injurious effects, especially on the part of the nervous system. Hence Prochownik recommends, at the same time, the use of vaginal tampons, which he introduces by the aid of Bozeman's hard rubber cylindrical speculum. The tampons are introduced, at first for a shorter, then for a longer period, on the days upon which massage is not performed. The latter need not be done more than two or three times a week, under such circumstances.

The temperature should be measured, especially in cases of exudation, in order to be enabled to combat accidents in time.

Recent inflammatory processes must be regarded as a contra-indication. The manipulations will always be attended with a certain amount of pain, but if the latter becomes violent and does not subside quickly, the case is not suitable for massage treatment. Thromboses or a suspicion of this lesion, endometritis with foul secretion, or the mere suspicion of purulent salpingitis, contra-indicate massage. This also holds good when erotic irritation is produced by the manipulations, but this is hardly to be expected in cases of congestion and exudation. In such cases the rectum may be employed instead of the vagina. On the other hand sexual irritation is unavoidable in certain of Brandt's manipulations in prolapse, cystocele and enuresis. For example, when the physician passes the finger with tremulous pressure beneath the rami of the pubes in order to stimulate the pudendal nerve, or exercises similar pressure upon the anterior vaginal wall, on both sides of the urethra. Such procedures are hurtful.

As a matter of course, pregnancy also constitutes a contra-indication, except in cases of vaginal cicatrices, very firm perineum, or when a strong perineum and recto-vaginal septum have been restored by operation. In such cases a sort of massage and artificial dilatation may be advantageously employed in the last month of pregnancy.

Uterine hemorrhages, pelvic abscesses and abortion have been observed as the result of this plan of treatment.

Winiwarter reports that he caused diminution in the size of an ovarian tumor by massage. This increases the absorption of the fluid contents, and may afford temporary benefit.

SUTURES.—HÆMOSTASIS.—LIGATURE EN MASSE.

Operations on the female sexual organs are often plastic in character, and usually require the bloody suture. Hence it seems desirable to make some general remarks on the subject, in order to avoid unnecessary repetition.

In former times great stress was laid, in regard to union by first intention, upon an intact condition of the general health, but this is much less important than was formerly supposed. We have observed union of extensive wound surfaces, despite wide-spread atheromatous degeneration of the arteries, embolic diseases of the brain, and even in pyæmic and subsequently fatal affections. In a midwife who had been infected with syphilis upon the finger, and suffered, in consequence, from tophi and lupus, but had never manifested any disease of the sexual organs, the extensive wound of a kolpoperineorrhaphy healed completely. Severe relapses of deep nasal ulcers, which had been brought to a standstill by temporary potassium iodide treatment, demonstrated the continuance of the constitutional disease. In another individual who had had condylomata lata upon the genitals, which had been removed by antisyphilitic treatment, the same operation was twice unsuccessful. Complete union did not take place until after the third operation, which was preceded by further antisyphilitic treatment. The main point seems to be the local changes in the parts operated upon, not the general changes in the fluids of the body.

This leads us to the chief factor in the success of union by first intention, *viz.*, the presence in the wound surface of a tissue which is rich in blood, and has no tendency to degeneration. Anæmic rigid cicatricial tissue is as little adapted to union as is the vascular tissue which exhibits a tendency to necrosis on account of its infiltration with a pseudoplasma. Union by first intention requires perfectly normal tissue, and is very easily secured in wounds of an hyperplastic but vascular vaginal wall.

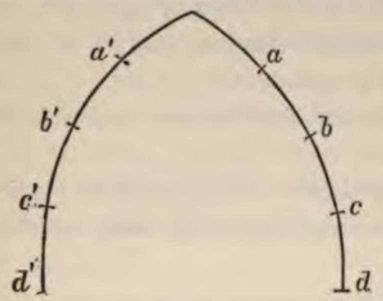

FIG. 78.

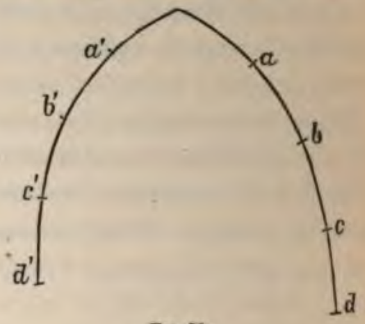

FIG. 79.

The proper shape of the wound is extremely important. Two completely symmetrical halves, which cover one another upon closure of the suture, should be made if possible. In plastic operations proper, we often have sufficient room to make the incisions in accordance with this requirement. In other operations, as in the extirpation of tumors or other parts, this factor should, at least, be taken into consideration. The production of two symmetrical halves is often extremely difficult or even impossible, on account of the often unusually flabby and convoluted character of the field of operation (especially the vaginal walls), and the original asymmetry of the structures on both sides of the median line of the vagina, or of the surface which is to be denuded for the operation.

Even the most expert may find that, after denudation is complete, he can not obtain two halves which can be properly adapted. This may be obviated in various ways. If the halves are symmetrical, the sutures, as a rule, should be introduced at equal distances, in order that exactly corresponding points may be drawn into coaptation (Fig. 78, *a* with *a′*, *b* with *b′*, etc.) If it is doubtful whether the points really correspond, the edges of the wound may be drawn together tentatively before the suture is tied. If one edge of the wound is longer than the other, this may be corrected by separating the sutures more upon the longer edge, and at the same time, distributing them as uniformly as possible (Fig. 79, *a* with *a′*, *b* with *b′*, etc.) Such a pian is only permissible when the difference between the two sides is not too great. But if the connection must, nevertheless, be made by means of the suture, the longer edge *b* (Fig. 80) is drawn into a fold at some suitable spot (*c*), the latter is brought into coaptation by itself, and then the shortened edge is united to the other (*a*).

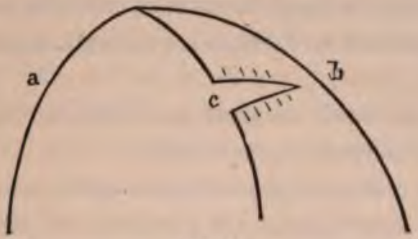

Fig. 80.

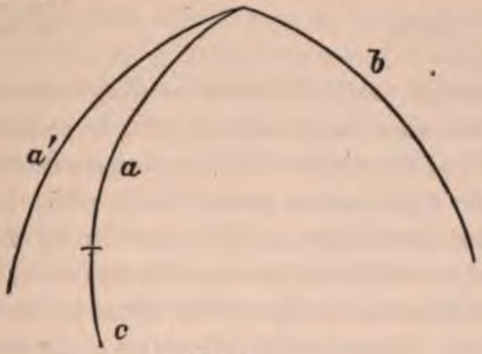

Fig. 81.

The second mode of correction is effected, not by means of the sutures, but by changing the wound surfaces. The short edge *a* (Fig. 81) is simply elongated in its original direction towards *c*, or it is cut so as to correspond to *a'*. In this way its length is made equal to that of *b*.

The wound surfaces, which come into coaptation, must possess a certain width. Surfaces of 1 to 2 mm. in width, do not unite as readily as those which are 10 to 12 mm. wide. But when a certain width is exceeded, the chances again grow more unfavorable, because it is more difficult to produce complete symmetry of the surfaces, and also because the suture is apt to compress the broader surfaces too strongly, and to throw them into folds.

In operations for fistula we must avoid denudations which are either too acutely or too obliquely funnel-shaped.

In covering any deficiency, our object must naturally be to oppose sufficiently broad wound surfaces at the site of the deficiency. If our incisions may be made in any direction, the direction in which coaptation occurs is immaterial, provided that the resulting tension remains the same. This is not true when the denudation must be performed in a certain direction. Let us suppose, for example, a urinary fistula, whose posterior boundary is the supra-vaginal portion of the cervix, inasmuch as there has been a deep loss of substance of the anterior lip of the cervix. The anterior rim of the fistula may be incised to any desired width in the vaginal vault. At the posterior edge of the fistula we have at our disposal only the thin wall of the supra-vaginal portion of the cervix. If we make a transverse elliptical denudation and unite the wound surfaces (Fig. 82), the defect, *i.e.*, the fistula, will be covered on the one side by the necessarily narrow surface which is made from the supra-vaginal portion of the cervix, and on the other side by the wound surface in the anterior fornix, which may be made of any width desired. But if the denudation is made along the longitudinal axis of the vagina, the defect itself (Fig. 83) may be covered by uniformly broad wound surfaces, and the unfavora-

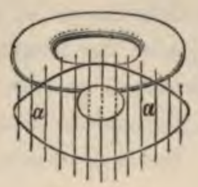

FIG. 82.

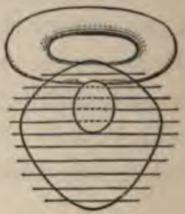

FIG. 83.

ble portion of the tissues is no longer employed for this purpose. It is eliminated in this way, and only plays the part of the portion *a* in Fig. 82. In this way we have cured several fistulæ which, in view of the fact that even the posterior lip of the cervix could not be employed for denudation, could only have been cured otherwise by kolpokleisis. Considerable advantages as regards denudation and co-aptation can be secured in a similar way by changing the direction of the incisions.

A wound surface, which is to heal by first intention, should be as smooth as possible. This can only be attained to a certain degree in flabby tissues, which present a different appearance with every slight modification of the tension, that is artificially produced during denudation. After denudation the surfaces are brought together, in such cases, in order to see whether they are properly in apposition. Further corrections may often be made, even while the sutures are being tied, and uneven places which become visible may be removed with the scissors or bistoury.

If the raw surfaces are entirely separate, each surface is completely included in the sutures. But if the symmetrical halves of a broad continuous raw surface are to be united, many believe that it is sufficient to include only a portion of each denuded surface in the suture. This view is erroneous. In such cases, which occur so frequently among plastic operations on the sexual organs, the sutures should be introduced almost beneath the entire base of the wound. Otherwise blood or secretion is apt to accumulate at the bottom of the wound, union by first intention fails and even infection may occur. If the raw surface is very broad, the needle, which is introduced at the edge of the wound, may be brought out near the median line of the wound and a small portion of the denuded surface on both sides of the median line may be left free, inasmuch as the needle is introduced on the other side at a little distance from the median line, and then brought out at the edge of the wound. But the parts not included in the sutures should be very moderate in extent (Fig. 84).

In the coaptation of very broad and wrinkled raw surfaces denuded tissue not infrequently pushes up between the edges, and can only be replaced by pushing it back with a pair of forceps. This is especially apt to occur if the needle is introduced at too great a distance from the raw surface, ro not exactly parallel with the latter. If the suture is drawn together forcibly, the projecting part being pushed back at the same time, too much tissue will be included. If this is not incised partial necrosis of the tense tissue will ensue, and union by first intention fails. Under such circumstances it is advisable to remove the superfluous tissue with the scissors before the suture is tied.

Werth first employed sunken catgut sutures in these very large raw surfaces. These are inserted into the base of the wound in such a manner that a deep portion is first united. Above this is placed the ordinary main suture. A second suture is sometimes inserted internally at another level. The knots are cut off short. This suture is mainly employed in prolapse and perineal plastic operations. It has also been employed in the intra-peritoneal treatment of pedunculated myomata. We regard this method as advantageous under certain circumstances in plastic operations, but cannot recommend it as a general method in all cases. We employ it in those cases in which, despite all our efforts, a very broad raw surface presents too many obstacles to coaptation by means of extensive sutures, and large masses of tissue would be enclosed by one suture.

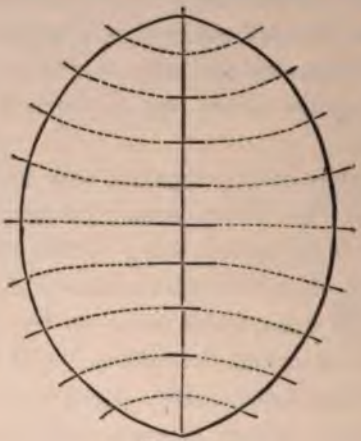

FIG. 84.

We believe that it is wrong in principle to permit such a degree of tension in plastic operations on the genitals, that such aids become necessary. Even in the very largest prolapse, therefore, we no longer prepare such broad surfaces that they cannot be united by the ordinary sutures without too much difficulty. Union by first intention is only possible with a certain degree of tension. If this is exceeded, the result becomes uncertain. Sufficient will be attained if we heal those cases in which the surfaces can be brought together before the limit referred to is reached. However, even the most expert will sometimes find that he has gone too far, and then Werth's suture will afford valuable assistance. In this way we also employ this method, but more than 1 to 2 sunken sutures are rarely necessary. In complicated ruptures of the perineum, when the raw surfaces are not so large, the sunken sutures are seldom necessary. But we must warn against placing too much reliance on this plan, against founding a special method upon it, and against neglecting the main principle in plastic operations, *viz.*, the avoidance of very great tension. Subsequent parturitions have shown us that some of our cases of prolapse operations have healed excessively, despite our avoidance of great tension. In women who have not reached the menopause, we have become very cautious and produce less denudation in them. Nevertheless, we have observed no great differences so far as regards the cure of the prolapse.

The frequent turning-in of the extreme edges of the wound is prevented by superficial sutures through the latter alone. Proper parallelism of the sutures to the raw surface, and the insertion and removal of the needle as close as possible to the edge of the wound, render many superficial sutures unnecessary. As a general thing, it is advisable to apply the sutures which encircle the entire base of the wound, at a distance of one cm. from one another, and to interpose alternate superficial sutures. The latter possess minor importance, but I do not think it advisable to limit their use still further. Apart from the turning-in, they also prevent the entrance of vaginal secretion or other noxious substances into the wound. The real object of the operation, *viz.*, union of the wound in the deeper parts, is indirectly furthered by them, and this constitutes their main benefit. Whether the outermost edges of the wound are in linear coaptation, is, *per se*, of minor significance, but its effect in aiding deeper union is not slight. As a matter of course, the chief importance is to be attached to the large, deep-spreading sutures. With the disregard of their importance found in Schroeder's work, it is very natural that new methods must be adopted in order to secure success. Hoffmeier is now on the right path, inasmuch as he strives for accurate coaptation in the deep parts of the wound, and attempts to effect it with the aid of Werth's sutures. We are unable to understand how Schroeder attributes to us the disuse of superficial sutures, although we expressly advised that they be used alternately with the deeper ones. We may sometimes use to advantage a moderately deep suture, which is inserted very close to the edge of the wound, and bends in at a depth of about 5 mm. As a general thing, it is rarely advisable to introduce the needle at a great distance from the edge of the wound. Good coaptation[1] cannot be effected then, because the sutures cannot readily be introduced parallel to the wound.

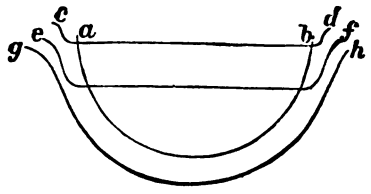

FIG. 85.

The so-called double suture, in which the needles are introduced and removed far from the edges of the wound, in order to relieve the ordinary intervening sutures from tension, has been rarely employed by us, and we have even preferred to introduce a greater number of sutures. Lateral incisions are rarely advisable, and can only exercise a favorable effect at the base of the perineum; they do not act upon the deeper parts.

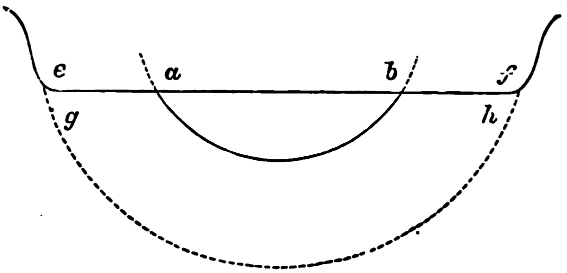

FIG. 86.

No blood or clots may remain between the raw surfaces, since this interferes almost always with union by first intention. The application of numerous sutures, firm ligature, and cleansing by means of the irrigator during closure will prevent this complication.

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[1] Figs. 85 and 86 are schematic representations of the sutures in the transverse section of the wound: *a* and *b* extreme edges of the wound, and the intervening curve is the surface of the wound; *c* and *d* are superficial, *e* and *f*, moderately deep, *g* and *h*, deep sutures. Fig. 86 is intended to show that, when the entrance and exit of the sutures are very remote from the edges of the wound, moderately deep sutures may often be applied parallel to the raw surface; but that this is rarely possible with deep sutures, for the simple reason that at such a depth from the raw surface, are situated structures which must be spared.

The best after-treatment is that which does the least. The catheter is used only in those cases in which the patients are entirely unable to pass the urine. Vaginal injections or constant irrigations we regard as injurious rather than beneficial. We make injections (under the slightest possible pressure) in those cases alone in which the secretion is copious and foul smelling.

The removal of the sutures depends upon the accessibility of the wound. If injury may be produced during exposure by traction and tension (and this is apt to occur in freshly united wounds) we allow the sutures to remain fourteen to twenty-eight days. If the wound is accessible, as in the raphe of the perineum, or the external genitalia, we remove them in 5 to 7 days.

Much has been said *pro* and *con.* concerning the merits of silk and wire sutures. It was claimed that wire is disinfected more readily, is less apt to produce suppuration, does not imbibe secretions, and therefore may be left for a longer time. On the other hand, it was said that the introduction of wire is more tedious and complicated; it is apt to break, especially on tying, the cut ends irritate surrounding parts, its removal is more difficult, and may injure the wound by traction.

Simon does not even concede to wire the above-mentioned advantages. At least he claims that his very fine, untwisted Chinese silk (No. 0) possesses the same advantages without any of the drawbacks of wire.

As a general thing, we prefer wire to silk in the suture of cavities. When left for a long time the wire is less apt to produce suppuration than even the finest silk, which always imbibes secretion. Hence Simon always removed the sutures early, whenever possible, and therefore often failed in prolapse operations. An experienced operator who possesses good material can apply wire as easily as silk, and the removal of the former has seemed to us to be easier in some respects than that of silk, at least in the deeper parts of hollow viscera. Each silver wire suture is readily distinguished separately. It is often difficult to distinguish individual silk threads, especially when several ends are close together. If we are experienced in the removal of silver wire and employ all auxiliaries, such as winding it around the forceps, traction in a curved line, etc., no traction is exercised upon the wound, though this possesses slight importance if the wire is removed at a late period. The superficial silver sutures, with their short, sharp curve, are removed with difficulty, and are apt to scratch the wound or to tear it slightly open, but this is not followed by serious effects.

When the sutures can be removed at an early period, *i.e.*, when they are not introduced within hollow viscera, silk is as serviceable as silver wire. Both should possess only a moderate thickness.

Next to silk and silver wire, catgut is chiefly employed for sutures. The latter is preferable when the ligatures are concealed, or when, on account of the difficulty of exposure, it is desirable to leave them in permanently, as in the rectal sutures of perineal plastic operations. Catgut is not suitable in those cases in which we desire to support the wound more than 4 to 5 days. Wire is then the best material, because it may remain much longer without producing bad effects. This cannot be said of silk, the capillary action of which enables it to absorb noxious substances; as a matter of course, this is especially apt to occur in the vagina.

Catgut will be still more generally employed in the future, because the material has been improved, and the means of disinfecting and preserving it have been perfected.

Sutures are applied either with simple needles and a needle-holder, or with needles which are set on handles and do not require a special holder. The simple needles are hollow, or possess an eye at the base, more rarely at the tip. Needles with handles are either hollow or have an eye at the tip. The latter possess the advantage of an unchangeable shape and direction. Even with the best holders the connection between the needle and the holder is not so firm but that at times, especially in unusual position of both parts, displacement may occur during use. On the other hand, we are deprived of the advantage, in using needles with handles, of selecting any desired curve, unless a very large number of needles is at our disposal. Such a choice may be easily made in the case of simple needles. In addition the relation of the latter to the needle-holder can be easily modified at any time; in the other form a special mechanism is required.

Needles which possess handles are either perforated throughout their entire length (Fig. 87), or only in a small part (Fig. 88). In the latter event a joint may be inserted beneath the hollow part, so that the position he needle with regard to the handle may be modified. They may be vided with an ordinary eye at the tip (Fig. 89) or a slit-shaped eye. llow needles are advantageous only when silver wire is used. In wing the wire through with a simple needle the wire often does not ain applied to the needle, but stands at an angle to it, so that difficul- arise, and parts of the tissue may even be torn. In using needles

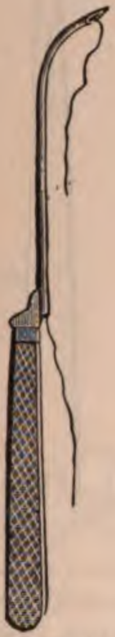

Fig. 87.

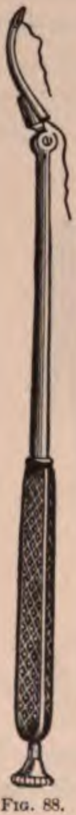

Fig. 88.

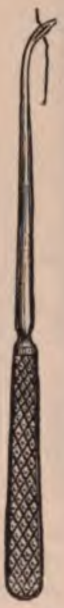

Fig 89.

h handles, the entire raw surface, or if they are separated by a gap, h raw surfaces must be penetrated at once. We can not, as in using ple needles, insert them through one half of the raw surface, bring m out in or near the median line of the wound, grasp them again, and s them beneath the other half of the denuded surface.

s soon as the tip of a needle, which has a handle, has been pushed ough, the wire must be seized with a hook or forceps, drawn from the eye or the hollow canal, and the needle then removed, in the same path along which it entered.

Simple needles can only be employed with the aid of a holder (Figs. 90, 91, 92). We employ in preference the instrument shown in Fig. 92. The needle-holder either possesses special grooves running in various directions, and into which the needles, which are quadrangular at the base, are inserted, or the inner surface of the terminal portion is provided with numerous fine serrations, or it terminates in soft metallic alloys into which the needles are pressed. The former are preferable, inasmuch as the alloy often does not last during a single operation, in which many sutures are employed.

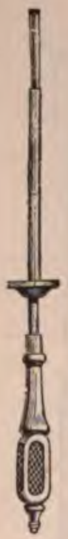

FIG. 90.

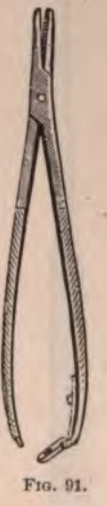

FIG. 91.

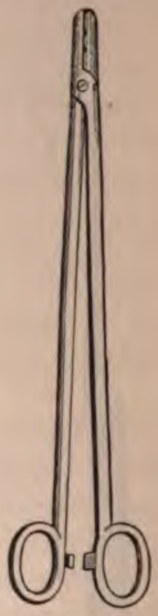

FIG. 92.

Fritsch has devised a good needle-holder, which allows the needle to be placed in any direction desired. Simple hollow needles possess the same advantages and disadvantages as the similar needles with handles, with regard to wire sutures. Perfectly round needles have the great advantage that they injure the tissues very little, and are not apt to wound a vessel. Needles with a lance-shaped tip, or which have a double cutting edge along their entire length, not infrequently give rise to considerable hemorrhage. Needles with a quadrangular base injure the tissues still more. On the other hand the latter are held more firmly in the needle-holder, and the lance-shaped needles penetrate very readily, even in very firm tissues. The round needles are apt to meet with obstructions, and it is especially difficult to secure them firmly in the needle-holder. Round needles are preferable where little resistance is expected, and hemorrhage from the points of insertion is to be avoided as much as possible.

The eye of almost all simple needles is situated at the base. Hence the needle must either be passed at once through both raw surfaces, or it is pulled out in the middle of the wound, then reintroduced, and withdrawn at the other edge of the wound. This is sometimes inconvenient, because the broad base of the needle is apt to injure the tissues unnecessarily, and this is aggravated by the manipulations necessary in again grasping the needle with the holder. Nor can this be avoided by passing the needle only from within outwards, *i.e.*, from the median line of the pared surfaces to the external edge of the wound; this is done by supplying the thread or wire with needles at both ends.

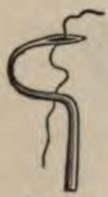

FIG. 93.

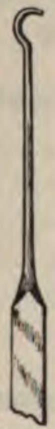

FIG. 94.

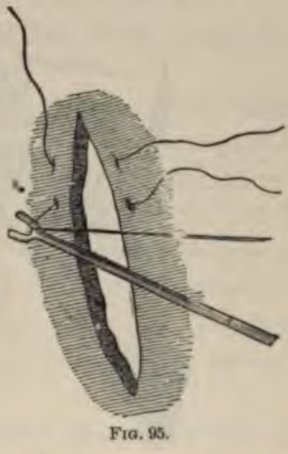

FIG. 95.

Simple needles may also be provided with an eye at the tip (Fig. 93). The suture is then applied in the same way as with the needles which possess handles. It possesses the advantage, however, that the relation of the needle to the holder may be modified at any time. A good instrument, which may be used advantageously with every form of needle, is a small blunt hook which, as soon as the tip of the needle appears, is pressed between it and the tissue, so that the latter is protected, the tip of the needle is exposed, and may be conveniently pushed further (Emmet's counter-pressure hook, Fig. 94). Sims's so-called feeder is also useful in some cases. It forms a sort of two-pronged fork, and is especially useful in giving a certain direction, while the silver wire is being drawn through, so that it does not cut. This is possible if the wire is drawn through at too sharp a curve (Fig. 95.)

A needle which we have recently received from Magdeburg, possesses a slit at the eye. Through this the suture is passed very easily and quickly, and cannot escape, as the edges of the slit have a slight spring (Fig. 96). This does not necessitate the insertion of the thread into the eye of the needle, and the assistant need not prepare the needles in advance, bu may take the sutures directly from the disinfecting dish.

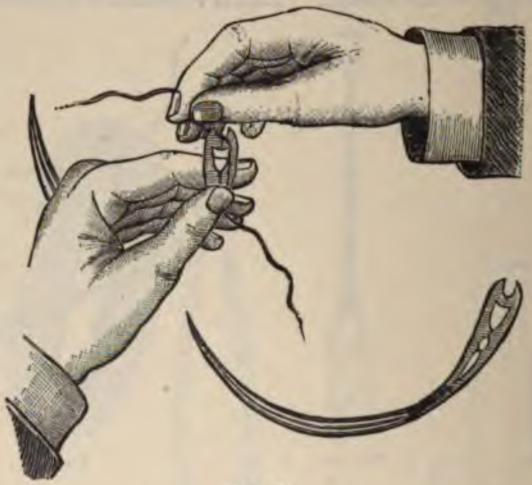

FIG. 96.

We have entered into these details on the subject of needles in order to make the subject clear to those who have little experience. For our own part we employ almost exclusively simple needles without handles, with the eye usually at the base, rarely at the tip, and with the needle-holder shown in Fig. 92. Much depends upon habit and experience, but at all events, we require needles of the most varied sizes and curvatures.

The tying of silk sutures needs no special description. The wire-twister shown in Fig. 97, seems to us to be the most serviceable. It is a long, round metallic staff, with a small S-shaped horizontal portion at the tip. One part of the S grasps one wire, the other grasps the second wire. Then the end of the instrument is pressed firmly upon the edges of the wound the wires are drawn somewhat taut, and then one, at the most two twists are made; if more twists are made, the best wire is apt to break. Then the twister is pushed back along the wire, and the latter is again twisted. By repeating this procedure, a knot is produced 1 to ½ cm. in length. This is bent to one side, and placed flat against the vaginal wall or the perineum. The ends sometimes produce disagreeable sensations, but we do not attempt to prevent this by the introduction of charpie, because these annoyances are insufficient to compensate the disadvantages of an object which absorbs the secretion of the wound, and can not be changed without traction on the sutures.

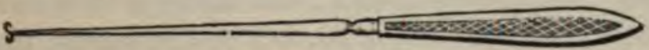
FIG. 97.

More complicated suture twisters have been invented by the American surgeons. Bozeman first draws the wires through the openings of a lead plate (concave internally), whose shape varies according to that of the wound. The wires are then passed through perforated shot, and drawn firmly against the lead plate. Finally, the shot is flattened by a special pair of forceps, and the two ends of the wire thus held together by compression. In removing them, the wires are cut beneath the shot, the plate is then removed, and finally the wires. Baker Brown fastens each wire with a small clamp.

In operations on the sexual organs the suture often serves as an important or even as the sole means of checking hemorrhage. As a general thing, ligature of vessels is but little employed. The hemorrhages are often venous or parenchymatous. The arteries, particularly those in the uterine walls, are seized with difficulty. As we are generally concerned in securing union by first intention, we can unite both objects at the same time. Very exact and careful suturing is often required in order to secure complete certainty, when there is a marked tendency to hemorrhage. In some cases one or more ligatures, which enclose a good deal of tissue, must be applied.

The employment of tampons and the actual cautery, as hæmostatics, has been discussed in previous chapters.

Hæmostatic forceps and clamps have recently been employed a good deal for checking hemorrhage temporarily. Koeberle's *pince hæmosta-*

tique, is a small forceps with spring blades, whose ends are slightly beak-shaped, and are provided with very fine serrations on the inner surface. Closure is effected by small openings in a projection on one blade, immediately above the handle, and into which fits a projection on the other blade. The compression is regulated by the presence of several openings (Fig. 98). Peán has a sort of catch on the handles of his hæmostatic forceps. The instrument shown in Fig. 99 is used for grasping large, broad pieces of tissue.

We prefer Hegar's hook forceps, which are provided with good slides. They are made of various sizes. The straight or curved tips are provided with a varying number of small straight hooks, and corresponding depressions, and also with small serrations (Fig. 100).

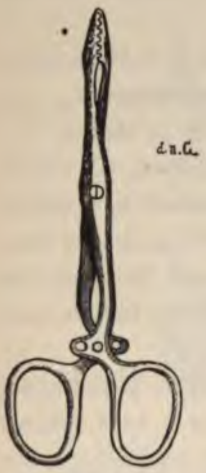

FIG. 98.

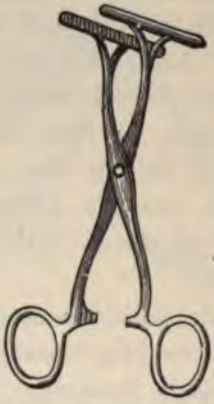

FIG. 99.

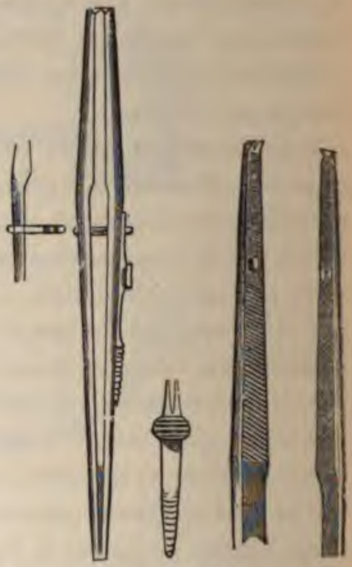

FIG. 100.

Valuable as these instruments are for temporarily checking the blood, we cannot recommend them for extensive use in permanent hæmostasis. This is only effected by producing a not inconsiderable necrosis of the tissues as the result of pressure. In plastic operations, this interferes with union by first intention; we prefer to remove the parts in question with the scissors before tying the sutures, if it had been necessary to use hæmostatic forceps during denudation, and to check the hemorrhage then by sutures. In other operations, particularly in laparotomies, hemorrhages from very small vessels, may be checked by compressing them for 5 to 10 minutes. This cannot be depended upon in the case of larger vessels, and it is then advisable to apply a ligature.

Ligatures *en masse* are hardly ever used by gynecologists except in laparotomies. At the present time catgut, silk and rubber are employed almost exclusively. Apart from the requisite firmness, these substances may also be readily disinfected. Unfortunately our judgment with regard to this matter is not yet ripe. Circumscribed inflammatory processes occur around all these forms of ligature, but we are unable to determine in any given case whether this is owing to the material of the ligature or to some other cause. There is no doubt that the former factor is not always an innocent one. It might be supposed that catgut would least of all give rise to such processes. But its use is attended not infrequently with exudations around the pedicle, and even with suppuration. Better and firmer catgut, which can be kept perfectly clean in Kuemmell's apparatus, has been recently made. For this reason we again employ this material, but our experience is insufficient to permit a final judgment. But catgut does not always suffice. If the tension of the ligaments is very great, as occurs not infrequently, for example, in castration with salpingotomy, if the pedicle is very firm and compressed with difficulty, if the danger of sliding off is very great, we do not trust to catgut.

Silk possesses the advantages, in this respect, that it cuts a little into the tissues. But it is disinfected with difficulty, and on account of its capillary action is more apt to absorb noxious matters, even if it has been well disinfected. It is a very significant fact that Czerny thinks it necessary to boil the silk for two hours in a solution of carbolic acid. Some operators have remarkable luck, and after the use of silk ligatures never observe peritonitic exudations, even among hundreds of operations. This is true of Tait, who does not even disinfect his silk. E. Martin called attention to the peritonitides which often develop around the pedicle, with moderate symptoms, and to the fact that, unless careful attention is paid, the ligatures often pass off unnoticed, attended with diarrhœal evacuations. I have also described such discharges of silk ligatures some time after ovariotomy, and Hueffell observed a suppurative peritonitis, which developed about two years after ovariotomy, and which undoubtedly started from a ligature.

Finally, we have observed suppurative pelvic inflammations 5 to 6 years after castration, on account of fibromata, and which probably were due to the same cause. Landau has recently reported a case in which parametritis developed long after an ovariotomy. Vesical symptoms developed six months later. A phosphatic calculus was removed, and within it was found the ligature.

Schroder found the ligatures, after myomotomy, in the vagina, after they had given rise, in many cases, to an annoying, purulent discharge. According to A. Martin, the ligatures are often discharged per rectum, occasionally through the bladder, often through the cervical canal, but most frequently through the abdominal wound, months and years after the operation, and usually without any reaction.

Hoffmeier regards such an occurrence as entirely innocuous, and Martin does not attach much importance to it. We may admit that the majority of these circumscribed peritonitides and parametritides finally terminate favorably, in so far that they do not prove fatal. But even this is not certain, and apart from occasional fatal cases, we often find very persistent and even incurable abscesses and fistulæ. A suppurating parametritis which ruptures into the rectum, and a calculus, which is produced by the passage of the ligature into the bladder, cannot be regarded as trivial.

The elastic ligature possesses the great advantage over silk that it may be thoroughly disinfected with corrosive sublimate (1:500-1000). We may use solid bands or thinner and thicker tubes. The latter seem to us to be better and more durable, but this may be merely accidental and dependent upon the mode of manufacture. If tubes are employed, the disinfectant solution should be kept within the tube for some time. Formerly we passed the tube once around the pedicle, crossed the ends, again passed it around and then tied it. This is necessary in order to prevent the ligature from giving, but, as a matter of course, an unnecessary amount of tubing remains in the abdominal cavity. Nor does this plan permit the ligature to be applied as firmly as by the following plan, devised by Hegar. The ligature is passed around once, drawn as tightly as desired, and then crossed. The crossing-point is then compressed with a specially constructed forceps (Fig. 101), which has no sharp projections (to avoid injury to the tubing), and possesses a catch. Then a silk thread or catgut is passed around the tubing between the forceps and pedicle and then drawn tight. The forceps are removed, the rubber tubing and thread cut off close. If we do not think that the latter is tied securely, a second silk ligature may be passed around the rubber tubing in front of the forceps. This plan is not alone very convenient, but is also much more rapid than the old method.

Unfortunately circumscribed inflammations around the pedicle also occur after the use of the elastic ligature, although we can hardly suppose that it is the result of imperfect disinfection in this instance. Nor is it possible that the rubber should absorb noxious material, either during or after the operation, as the result of capillary action.

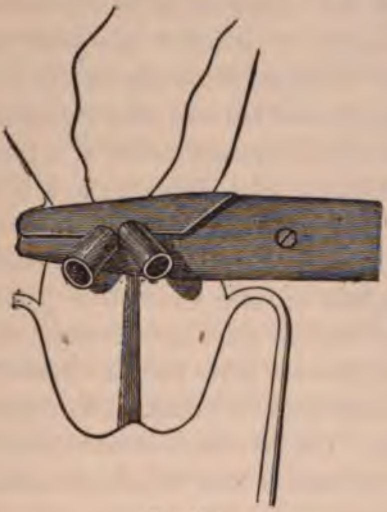

FIG. 101.

The inflammation or abscess formation must therefore be due to some other cause, which has hitherto evaded our search. In some cases the Fallopian tubes appeared to me to be the source of infection. This is truer of castrations, especially for pyosalpinx, in which such a mode of infection may probably occur as it does in amputation of the cervix from the mucous membrane. In ovariotomies and the extirpation of pedunculated myomata disease of the tubes is rare, and such an explanation is unsatisfactory.

Prevention of Surgical Infection.—Seasons.—Locality.—Distribution of Patients.—Operating Room.—Utensils and Instruments.—The Patient.—The Operator and his Assistants.—Spray and Irrigation.—Antisepsis in Laparotomy.—After-treatment.

Semmelweiss laid the corner-stone of the doctrine of antisepsis. He proved the identity of so-called puerperal fever with pyæmia and septicæmia, and attributed these diseases to decomposing organic matters. As early as 1847 he had attributed puerperal affections to careless examinations after previous examination of a patient suffering from cancer. He also attributed other infections to a patient suffering from caries of the knee joint. He also described the mode of contagion by means of the hands, instruments and utensils, and limited infection through the atmosphere in rarer cases. The protection derived from uninjured epithelium was also well known to him. In a small number of cases, he assumed the presence in the body of a material which is extremely capable of decomposition (self-infection). The disease can only be combated by prophylaxis. The preventive measures are the strictest cleanliness, the avoidance of contact with infectious matters and individuals, and the use of chlorine.

These views did not gain ground until the 6th decade of this century, and then among obstetricians alone. Lister inaugurated the antiseptic method among surgeons. He devised a complicated method, in which destruction of the germs by disinfectant fluids and vapors, protection of the wound by disinfectant bandages, and finally Chassagnac's drainage are combined in such a way that the importance of each factor is determined with difficulty. A good deal must be attributed to the greater cleanliness. In recent times a certain degree of reaction against the use of antiseptics is developing. The opinion of the older surgeons that operations are better tolerated during the warm seasons is still accepted by the laity. There is some foundation for this belief. Whether the temperature, degree of moisture, etc., play a part *per se*, is determined with difficulty. On the other hand we are well acquainted with the indirect effects of some of these factors. Bad air in the rooms, the crowding of numerous individuals into one apartment, cause increased spread of infectious diseases. Moreover the general condition of the individual is decidedly impaired in the second half of the cold season. But it is not practicable to defer until summer the operative procedures, even those in which delay is justifiable. Moreover, even our imperfect knowledge of the way in which the seasons exert their influence, furnishes us with the means of combating this influence. The air in the rooms may be improved, and it is also in our power to act favorably upon the general condition of the patient. Our present antiseptic measures are of such a character that we no longer need to consider the season of the year. But certain months of the year, *viz.*, February and March, appear to be attended with special danger. In these months we also hear more of infectious diseases, such as diphtheria, erysipelas, furuncles, etc., outside of hospitals. It is evident that the injurious factors of winter produce their greatest effects in these latter months, on account of their longer period of action. If such diseases are rife, it is best to postpone operations, whenever possible.

The question arises with regard to gynecological patients, especially those who require mechanical or operative aid, whether treatment in private houses is not preferable to that in special hospitals or institutions. The poor must be treated in these institutions, even if the treatment is of a non-surgical character. Among the well-to-do, much can be done in private practice, but not everything, or at least, only in a very inconvenient manner. In some patients the condition is of such a nature that success can only be attained under the constant supervision of the physician, trained nurses, and the entire auxiliary paraphernalia of a hospital. It is often very difficult to secure artificial disinfection of private rooms, and of the furniture and utensils contained in them. In many cases the family of the patient form a disturbing element. Furthermore, on account of the difficult technique of many therapeutic methods, the time at the disposal of a busy specialist will not suffice for treatment in private houses. In time gynecological attainments and skill will be more widely diffused among physicians than at present. But, as in ophthalmology, the diagnosis and treatment often require so much technical experience and skill, that they can be attained only by a few, and that, except in a hospital, they can be acquired only after the greatest sacrifices and persistency.

The principles ventilated in recent times with regard to hospital buildings also hold good, as a general thing, with regard to buildings which are destined for gynecological operations. We can not discuss these in detail, but will merely consider a few special conditions.

In Germany obstetrics and gynecology are intimately connected, and this is very natural, since the former is evidently the basis of the latter. A thorough knowledge of diseases of women, especially of their origin, and the requisite diagnostic skill are impossible without a thorough knowledge of obstetrics.

But however suitable is the union of both specialties in one person, the combination of an operative gynecological clinic and a maternity hospital in the same building is only justifiable under certain conditions. The apartments, nurses and instruments used in the two branches must be kept separate.

It is not even advisable to keep all gynecological patients in one building. Cancer patients, in whom the removal of the entire tumor or its partial extirpation, with cleansing of the ulcerated surface, is no longer or not immediately possible, do not belong in a hospital in which operations are to be performed. They render the air pestilential, and place others in the greatest danger. It is often very sad to be compelled to refuse such patients, who place their last hopes in their admission. In many proper treatment would produce temporary good effects, and ameliorate their dreadful sufferings. It would also be useful to instruct the internes in the treatment of such cases. But nothing can be done for them except in a special building and with special attendants.

In addition to such cases, individuals who suffer from urinary fistula, or in whom enucleation of a fibromyoma is to be performed, are also hurtful to the atmosphere of a hospital. The latter cases are rare and require isolation. In cases of urinary fistula we can obviate the difficulty by operating as soon as possible. The patients are then usually able to pass the urine voluntarily, and its decomposition then ceases.

Special conditions are presented in laparotomies. Recent experiences indicate the direct or indirect influence of locality, so that the advisability of performing the operation in ordinary hospitals appears doubtful. As the entire question is very complicated, we will reserve it for future consideration.

Fumigations with chlorine and bromine are suitable for the disinfection of apartments, and their action may be increased by moisture. Sulphurous acid, which is produced by burning sulphur, unfortunately pros

sesses no disinfectant properties, but we often employ it as a
against vermin.

The room in which operations are performed requires thoro
fection. In operations in which the danger of septicæmia is
as in laparotomies, the number of lookers-on should be limite
cial ventilation is very useful in order to prevent the impregna
atmosphere with the vapor of chloroform and ether, and the
from the attendants. This is very often effected by means of
which is worked by a gas jet. In order to purify the air as it enter
through which it passes may be so arranged that the air flow
between disinfecting substances. If the tubes through wh
enters empty partly into a pipe of a stove (which may even
necessary, in summer), extremely vigorous ventilation will be

The temperature of the operating room should be as uniform
A temperature of 14-15° R., will suffice for the majority of
An elevation of a few degrees may be advantageous in laparoto
elevation of temperature to 20° R. or more, is attended with
inconveniences. This has been recently recommended on
Wegener's investigations, but it is forgotten that he referred
the very extensive exposure of the entire peritoneal surface.
is rarely necessary in practice, and should also be avoided
reasons. A. Martin, however, removes the intestines from the
cavity, and places them upon the upper part of the abdomen
cloth, which has been moistened with a weak solution of ca
Much may be effected if the patient is carefully covered.

The operating couch also requires careful disinfection. Ease
must be taken into consideration even in its construction.
pecially true of the pillows and cushions, which must be co
waterproof material. This is more difficult with regard to
and metallic parts, as easily decomposed substances are apt
the joints and crevices. Thorough cleansing with disinfectant
placing the couch in the room which is exposed to fumigation
rine, will not always prove sufficient. If numerous operation
the couch must be changed occasionally. An operating table,
been frequently used, should be exposed for a time to the ai
and at the same time thoroughly cleaned. To a certain extent
true of the examining table. Even if we do not believe that

itself conveys noxious substances through the atmosphere, it must be remembered that the hand of the physician, the instruments, etc., which necessarily come in contact with the couch, will diffuse such substances.

It is very difficult to mention and observe all the precautions with regard to the cleanliness of the utensils necessary for any operation, which are demanded by the current doctrines. The vessels which contain hot and cold water should be made of metal, glass or porcelain, so that they may be readily cleaned. They may not be used for other purposes, and the water itself must be pure; if not, it should first be boiled and a disinfectant added. As the water must frequently be changed during a long operation, steps must be taken so that this may be done quickly without neglecting any precaution.

The sponges, after being squeezed dry, are placed in boiling water, then for twenty-four hours in dilute hydrochloric acid, then washed, dried, and hung in a dry spot in a cotton or linen bag. Before using these sponges they are placed for twelve hours in a 5 per cent. solution of carbolic acid. They are then washed and placed in the water, to which a moderate amount of disinfectant has been added, which is to be used during the operation. We have no fear of again using sponges which have been employed in an operation, unless particularly noxious substances, such as ichor, etc., have been handled. After the sponges have been used they are placed for twenty-four hours in a solution of soda, and then washed to remove all traces of blood; then washed in a solution of carbolic acid, dried, and kept as described above. The subsequent employment of the sponges is greatly curtailed on account of the wear and tear produced by these procedures.

Towels should be kept separate, according as they are used for examinations and less dangerous operations, or for laparotomies. They should be washed separately, placed in dilute chlorine water and then dried.

Irrigators must also be kept separate according to their purpose. The tips are to be made of metal, or still better, of glass.

The cleanliness of the instruments proper is greatly facilitated by keeping them in separate cases.

In a large clinic there should, at least, be separate cases for the special instruments used in laparotomy, in certain other frequent major operations, such as prolapse, and in examinations. If this cannot be done, on account of lack of means, the different kinds of instruments should least, be kept separate. Much may be done by the proper selection of the material of the instruments. Nickel plating prevents the rusting of many metallic instruments and facilitates their cleansing. Whenever possible wood should not be used for handles, or for making certain apparatus, but should be replaced by metal or hard rubber. Inequalities, grooves and furrows should be avoided as much as possible in the manufacture of instruments.

After simple instruments are used, they are washed in pure water and then dried. More complicated instruments and apparatus, which present irregularities, such as hooks and forceps, must be treated with soap and brush, soap and alcohol. Before the operation they are again cleaned or even boiled in disinfectant fluids. It is still better to use, in accordance with Bose's advice, a sterilizing box, in which the instruments are exposed to hot air. It may be so arranged that the instruments are taken from the box during the operation, or they are disinfected in the manner described above, and then placed in a weak solution of carbolic acid.

The following remarks may be made with regard to the person of the patient: care must be taken that nothing adheres to her person which may give rise to poisoning. Prior to the operation she may not lie near individuals who are suffering from suppuration, gangrene, etc. On the day before the operation the patient should, if possible, take a warm bath, and then is given clean clothing and bedding. The site of operation is carefully treated with soap, alcohol and disinfectant fluids. The vagina is irrigated, even if it is not involved in the operation. The clothing worn during the operation must be perfectly clean and disinfected. The patient sometimes suffers from affections such as furuncles, eruptions, etc., which may cause infection of the wound. In the Freiburg obstetrical clinic only a single fatal case of infection occurred in three and a half years, in an individual who suffered from a felon, and had not been examined during parturition. Such affections must first be relieved, whenever possible. This cannot always be done, or only in an imperfect manner, as these affections are sometimes caused by the disease on account of which the operation is performed. For example, a carcinoma of the body of the uterus, a fibroma or an ovarian tumor, may be associated with endometritis and purulent secretion, retention of the secretion from flexion or compression of the cervical canal. This results in irritation by the acrid secretion, or even in absorption of the secreted matters, and thus in the affections of the surface of the body. As we are not always able to prevent this entirely, we should at least endeavor, during the operation itself, to prevent the transportation of the noxious material to the wound, for example, by a suitable bandage, etc.

Purulent colpitis and endometritis, especially those which are gonorrhœal in origin, are extremely dangerous. Perhaps even moderate residua of previous gonorrhœas possess infectious properties. Serious disturbances are apt to arise in this way in slight operations and manipulations which, on account of their trivial character, are often neglected. There is no doubt that some of the dangerous or even fatal affections after the introduction of the sound, dilatation with tents, or even simple explorations, have been caused in this way. To Noeggerath belongs the credit of having first pointed out the dangers of gonorrhœal infection. Schultze emphasized the importance of careful antisepsis in minor operations, and of various precautionary measures, particularly of uterine irrigations.

The first requisite on the part of the operator and his assistants is their freedom from any disease which may give rise to infection. Great danger is incurred if they suffer from felons, furuncles or pustules. Ten years ago the midwife of our Institution, who suffered from a superficial felon with mild lymphangioitis, infected two puerperal women, one of whom died, the other lay sick for three months. The medical staff may also convey infection by carrying noxious material upon or perhaps within the body, even though they themselves are not affected. The infectious matters may adhere to all parts of the body, especially those which are exposed, and which thus come directly in contact with poisonous, easily decomposed substances. Every one knows how long the hands and even the hairs smell, after working in the dissecting room. It seems as if even the buccal cavity and respiratory organs retain these substances upon their surface for a certain length of time, since even the breath exhales the peculiar odor. Perhaps the blood itself absorbs the odoriferous particles, and then excretes them during expiration. Ether, which has been inhaled in order to produce anæsthesia, is undoubtedly removed in this way, as it is often smelt distinctly in the breath for twenty-four hours afterwards. Even at the end of this time the exhalation may be so strong that the smell of ether is noticed on entering the room. This cannot be due to the clothes, since it is noticeable even if the patient receives fresh clothing after the operation. Nor is it probable that the mucous membrane of the mouth and respiratory organs should retain the ether for such a long time. A well-known fact is the intensely disagreeable odor from the mouth in certain women during menstruation. This is probably explained by the decomposition of substances in the uterus and vagina, their absorption, and exhalation in the expired air. An important fact, to which Mayrhofer first called attention, is the presence of masses of bacteria in the buccal cavity, particularly in the spaces between the teeth, and in carious teeth. The adherence of infectious matters to all kinds of clothing is well known, and it is well to call attention to the fact that gloves may become impregnated, perhaps to a very marked extent, as they are generally made of slightly permeable substances, and are applied to these parts of the body which come in contact with poisonous substances.

If these facts are true, of which there can be little doubt in the present state of the doctrine of infection, the practical measures to be adopted follow of themselves. The operator and his assistants must avoid contact with suspicious patients and objects, if the operation, as, for example, laparotomy, carries with it a considerable danger of infection. Their clothing should not be exposed to such contact, and should not be kept in unclean localities, or at least, they should be thoroughly cleaned. Shortly before the operation a warm bath should be taken, and at the same time the hair should be washed. Specially reserved underclothing and freshly washed linen clothes should be worn during the operation. After the clothing is put on the operator should not visit a sick room or water-closet. Mayrhofer recommends the application of a respirator, in order to retain the germs which are contained in the buccal cavity, and carried off in expiration. But this is carrying things to the extreme. If any importance is attached to the matter, our object can be attained by carefully cleansing the mouth and teeth, immediately prior to the operation, and by brushing and gargling with a disinfectant fluid. The cleaning of the hands requires the greatest care. Washing with turpentine and soap, and then with water to which chlorine, carbolic acid, permanganate of potash or corrosive sublimate has been added, is not always sufficient. If the fingers have been in contact with coloring matters, blood, etc., small particles adhere to the nail-bed and beneath the nails, and cannot be removed by such procedures. When these particles are situated beneath the nails, they cannot be entirely removed, even with the aid of a nail brush, and the blade of a knife must be used. They can be removed from the nail-bed by means of a brush, but only if the projecting cutis layer has not been cut away and pushed back. Otherwise the parts contain small fissures and depressions, in which decomposing substances burrow, and from which they are removed with extreme difficulty. The physician should rarely pare the nail-bed, partly on account of the patient, partly on his own account, since he is apt to be infected in this locality, as is well recognized by anatomo-pathologists. The difficulty of thoroughly cleaning the nails justifies the rule previously laid down that infectious matters should be avoided for several days before a difficult operation.

The precautions just mentioned are adopted in order to prevent the transmission of poisonous substances by the physician, attendants, utensils and instruments. Their neglect is followed by various consequences, according to the occupations of the physician and his assistants, and the inmates of his hospital. The precautions are usually furnished *à priori* when the physician concerns himself with a special form of operation, or in a hospital which contains only a certain class of cases, in which there is but little decomposing material. But the precautions must be carried out strictly if the hospital contains all sorts of patients, pregnant and puerperal women, and if the physician performs the most varied explorations and operations.

Laparotomies should be performed in the morning, before the operator and his assistants have entered a sick room. It is also advisable to limit the number of assistants and instruments as much as possible.

But it would be wrong to regard septic infection as impossible, even after all the precautions mentioned have been adopted, or, if infection does occur, to attribute it to laxity in carrying out these rules. A further and considerable source of sepsis is owing to the fact that, in an operative procedure, an easily decomposed material is produced which decomposes under the influence of the ferments in the air or the body itself. Such material is furnished by the secretion of the wound, blood, and necrotic tissues. It is, in the main, a part of operative technique to obviate this source of sepsis by careful ligatures, cleanliness, firm suture of the wound, etc.

The removal by drainage of fluids which are decomposed, or liable to decomposition, will be discussed later.

To prevent infection during the operation, the spray is often used, the vapor of water either with or without the addition of a disinfectant being employed. If the spray is merely intended to wash the parts, it is better to replace it by an irrigator. In laparotomies it possesses the disadvantage of annoying the operator, and if it contains carbolic acid, certainly exercises no beneficial effects upon his health. In addition it may be assumed that it carries floating germs into the abdominal cavity. These disadvantages are avoided if the room is subjected to the spray before the operation, but is discontinued shortly before the latter begins. The moisture in the air, and its subsequent precipitation, are capable of precipitating particles of dust and germs. Although infection by germs floating in the air does not appear to play a great part, nevertheless the spray may act as a protection against such rare occurrences.

In ordinary surgical operations the wounds may be carefully washed out. In certain cases, especially under the very favorable conditions presented by plastic operations, they may then be closed with sutures, or they are drained and an antiseptic bandage applied. The object of the drainage is to carry off fluids which are liable to decomposition. Hence, implicit faith is not placed in primary antisepsis. It is only very recently that surgeons have discussed the question of complete closure of the wound without drainage, and even then they do not carry out this principle strictly, since they leave a hole here, or a broad groove or artificial channel there, for the escape of secreted masses.

In certain gynecological operations the conditions are the same as in specially surgical procedures, and the results are at least equally brilliant. More than 100 cases of prolapse were operated upon in the Freiburg clinic in the last three years, the two or three different procedures being usually finished at one sitting. Very extensive raw surfaces, opening into numerous venous spaces, are thus formed, and in former times the operation was quite dangerous (Simon lost two patients among his first twenty cases). In our clinic we operate in the ordinary amphitheatre, immediately after the clinical lectures, which are attended by 80 to 100 students, and with the ordinary antiseptic precautions. One patient died two or three hours after the operation from pulmonary œdema, secondary to chloroform narcosis in existing heart disease. Not another severe affection was observed and not a single unsuccessful result. Here the ordinary surgical antisepsis proved entirely sufficient. On the other hand, although we adopted much stricter measures, separate room, limited number of spectators, operation before visiting other patients, we were unable to prevent septic infection entirely in laparotomy.

We cannot rely upon antisepsis in this operation with the same certainty as in equally serious operations upon other parts of the body. Thompson's statement that abdominal surgery afforded no test of the value of antiseptic treatment is justified, if we refer only to ordinary surgical Listerism. Apart from the measures employed to prevent infection during the operation, a great part is here played by the subsequent methods of secondary antisepsis, especially those which serve for the removal of the secretion of the wound. Unfortunately such a plan is entirely wanting in laparotomy, or it is so imperfect that it is employed only in rare cases. After the abdominal cavity is closed, the matter is entirely beyond our jurisdiction. Hence we must endeavor to make the operation as completely antiseptic as possible, and this constitutes the great difference between us and the surgeon.

The surgical operation, which is to a certain extent analogous to laparotomy, is the opening of large joints,[1] for example, the knee joint. And yet the conditions are much more favorable in the latter case, because the cavity may be washed out with the greatest ease during and after the operation. Nevertheless the surgeon introduces drainage tubes, if any serious operation is performed within the joint, an operation which often cannot be compared with a difficult ovariotomy, in which there are large bleeding surfaces, contused and destroyed tissue. Indeed, drainage is employed not infrequently in excision of a floating cartilage, which is generally such a simple operation. As a matter of course the test of complete antisepsis is not made in the operation unless the drainage tube is dispensed with. It seems to me as if the experience hitherto obtained in this respect is not very favorable.[2]

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[1] Whether the tendency to receive noxious germs or to yield to their influence is greater in synovial membranes or the peritoneum, is difficult to decide, but at all events it is marked in both. It is an astonishing fact that not alone does the sensitiveness of the peritoneum in this respect vary considerably in different species of animals, but age also gives rise to similar differences. Horses and mules tolerate opening of the abdomen very poorly, cows and dogs tolerate it very well. Hence, too great importance may not be attached to experiments on animals, especially on dogs. The young pig is very resistent; an old boar is much more apt to die in consequence of castration.

[2] Vide Lueddecke, Ueb d. Verletzungen groesserer Gelenke. Inaug. Diss. Halle, 1884, page 21, No. 54. A very easy operation as the floating cartilage was fixed; nevertheless, fever and considerable exudation into the joint, necessitating punc-

We do not by any means raise objections to the antisepsis of surgeons. They have achieved the most excellent results, and their method seems to be entirely adequate. But we regard the explanation of their results as erroneous, in so far as they are attributed mainly to the complete asepsis of the operation. We must also maintain that such antisepsis is insufficient for laparotomies.

Is it possible to make a capital operation like ovariotomy positively aseptic? Unfortunately this cannot be done, and probably will never become possible. The precautions employed in the bacteria laboratory can not be adopted, and even there cultures sometimes prove negative. At the most, approximate certainty can be attained by roundabout ways, which will be discussed later.

Hitherto no method has been proposed and generally accepted, according to which operators of equal technical skill will achieve the same results in similar cases. The difficulty of securing the necessary antisepsis for all cases of laparotomy is sufficiently shown by the divergent measures of operators—measures which often have no relation to antisepsis, and which would be entirely superfluous if we possessed a thoroughly reliable method.

If, for the present, we disregard the fact that one very lucky laparotomist entirely discards the so-called antiseptic method, all are agreed that some disinfectant, carbolic acid or corrosive sublimate, should be used for cleaning the person, instruments and utensils, and, to a greater or less extent, for washing the external wound or the peritoneum itself. The special recommendations for cleaning the room, operating table, instruments, sponges, towels, patient, operator and his assistants, present no essential differences. It is generally recognized that it is advisable to limit the number of assistants, instruments, and utensils as much as possible.

Only a certain number of spectators should be allowed to be present.

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ture and washing. If the abdomen, instead of the knee, had been the site of operation, the patient surely would have died. In such cases Volkmann introduces a primary drainage tube if extraction is difficult, if adhesions must be separated, arteries tied or considerable secretion is to be expected. Even, then, everything does not run smoothly as in an extremely easy operation reported by Volkmann, in which the foreign body was fixed upon the external condyle of the tibia. Nevertheless there was suppuration of the canal of puncture and slight exudation into the joint, an indication that the irritation was not confined to the canal.

The recommendation to abstain from the operation if we have come in contact with a strongly infectious patient or object one or two days previously, and not to employ an assistant who has had the same experience, is approved by the large majority of operators, but regarded by some as superfluous. Olshausen sees no objection to employing an assistant who has handled a cancer or ichorous abscess the day before.

Now it may be admitted that, from a theoretical standpoint, perfect cleaning is possible. It is also probable that in antisepsis we often aim at sparrows with cannon-balls, that we regard as dangerous much that is not so, and that we are unable to avoid with certainty what is most objectionable. The further progress of bacteriology seems to be providing peculiar surprises for us. I will remind you merely of Gusserow's statements concerning the virus of erysipelas or Aufrecht's experiments on that of diphtheria. But for the present we may not discards the tedious precautions which later will probably be dispensed with in part. Although we think that it is possible theoretically to disinfect a person sufficiently, nevertheless we do not think that such a theoretical standard can be attained in purely practical matters, and it seems to us that the avoidance of everything which may produce infection, is better than all Listerism. At the same time careful attention must be paid to the room. If this is infected, disease may be conveyed by persons or utensils, despite every precaution.

Apart from these points, concerning which there is substantial agreement, we will find great differences in other matters. The methods of individual operators are grouped with difficulty from a common standpoint. The factors are too numerous and the reports not always sufficiently complete, to furnish an accurate picture of the method of the operator.

Some operators lay chief stress on the greatest possible rapidity of the operation, very little or no consideration being paid to the complete cessation of hemorrhage, the removal of cystic fluid which may have been poured into the abdominal cavity, even of pus, tissue *débris*, or cystic contents. The abdominal cavity is to be closed as rapidly as possible. Martin makes extensive use of the spray, which Olshausen has abandoned. These two writers are the chief advocates of these principles. Martin, at least, appears to have obtained good results in ovariotomy in accordance with these doctrines. Among 100 cases he lost only two patients, and only one from sepsis. But we are unable to form a thoroughly competent judgment before detailed descriptions are placed at our disposal. Olshausen's fuller reports do not seem to us to testify in favor of too great neglect of the toilet. The mortality in the first period after the operation was 11½ per cent., not a very unfavorable result. But fatal terminations also occurred subsequently from abscess and abdominal fistula, in two cases from ileus. In two other fatal cases renal disease was mentioned as the cause of death, in a third case apoplexy. It is also a striking fact that in two cases it became necessary to reopen the abdomen, on account of ileus, following extensive adhesions of the intestines. We also find mention made of a not inconsiderable number of circumscribed inflammations, among which may probably be included those in which convalescence was attended with considerable or protracted fever. Finally, myxoma and colloid of the peritoneum occurred among the sequelæ. But we are not justified in attributing all these results to the imperfect toilet. This can be predicated with certainty of the myxoma and colloid of the peritoneum, but only with more or less probability of the other affections, since many other factors come into play, for example, the mode of treatment of the pedicle. It would, therefore, be very interesting to obtain a similar report concerning operations in which the other method of treatment of the pedicle was adopted.

Olshausen's observations are extremely interesting, inasmuch as they destroyed certain illusions concerning the prognosis in ovariotomy. Apart from the sequelæ mentioned, eight relapses are reported, partly of benign, partly of malignant tumors, five of which proved fatal before the end of a year.

The patients cannot be regarded as restored to health, especially if they leave the hospital on the 10th to 14th day, at a time when the abdominal wound may burst open. Much may happen subsequently, which may change the result very decidedly, even with reference to mortality.

This plan of treatment is contrasted with another, which is based on the principle of careful toilet, very little attention being paid to the rapidity of the operation. When the abdominal cavity cannot be cleaned, either on account of the condition of the patient or the excessive duration of the operation, drainage is resorted to. The chief advocate of this principle is Keith, who, for a time, substituted the carbolic acid spray for drainage, but finally discontinued the former. Whether and to what extent Keith uses disinfectants, we do not know. He does not operate rapidly. At least, in his report for 1883, we find that many ovariotomies lasted much more than an hour, and even as long as two and a quarter hours. The results are excellent, especially if the many difficult cases are taken into consideration. Keith also obtained similar results before the antiseptic period. Equally good are his results in hysterotomy for fibroma with extra-peritoneal treatment of the stump (11 successful operations, most of which were very difficult.)[1]

Finally, we will consider the views of a surgeon (Tait) who proclaims himself the foe of antisepsis, although he adopts certain measures which are justly regarded as antiseptic.

Tait claims that a surgeon or gynecologist who visits other patients should not make laparotomies. If I understand him rightly, he pleads for specialists in laparotomy. He does not think that it should be performed in a hospital which admits cases of different kinds. He is also very strict in the recommendation that neither the operator nor his assistants should meddle with autopsies or suspicious patients. (*Path. and Treatment of Diseases of the Ovaries*, 1883, p. 254.)

Tait does not use disinfectants, and even considers them injurious. His sponges, however, are kept for some time in a 5 per cent. solution of carbolic acid. Otherwise, ordinary water is used for cleaning the wound and even for washing out the abdominal cavity, which he strongly recommends. He repeatedly pours in large amounts of fluid and washes the intestines with the hand. The instruments are also placed in ordinary water during the operation. Ordinary absorbent cotton is used for dressings. The silk is merely placed in boiling water in order to remove the rubber.

According to his statistics Tait is by far the most successful of all living operators, but too much reliance should not be placed on statistics of this kind. Intentional concealment of unfavorable terminations is out of the question, but there may be self-deception, an artificial classification according to methods or merely modifications of methods, so that nothing is said of the bad results which have followed other methods. Much may also be done in this way by a suitable classification, in which certain unfavorable periods are omitted, or by definitions, which are used in a different sense from those ordinarily employed—as, for example, when the term ovariotomy is applied to what is generally known as castration.[1]

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[1] Keith is said to have performed 20 successful myomotomies in succession.

A great part is played, in Tait's statistics, by exploratory incisions and incomplete operations. Whoever excludes all unfavorable cases after an exploratory incision (whose recommendation by Tait we do not entirely understand in view of the perfection of diagnosis), has decidedly better chances of favorable statistics than one who is less politic. The so-called incomplete operations exert a still greater influence. Here all fatal cases after unfinished operations, *i.e.*, especially after the more difficult ones, are excluded. As a matter of course, caprice may then play a great part, inasmuch as the term incomplete operations may be used—for example, if part of a cyst is left behind after ovariotomy, or part of a tube in salpingotomy, or a small piece of the ovary in castration. In addition there is also a great advantage compared with the surgeon who completes such difficult operations, since, as a matter of course, more unfavorable results will be obtained under such circumstances.[2]

To all this must be added the different principles followed in the sele-c tion of cases, and finally the incalculable differences in the cases themselves. It is entirely in accord with the doctrine of chances, that one physician should have 70 difficult cases, another 70 mild ones, among 100 cases, perhaps even more probable than that an operator should lose a certain percentage from ileus, embolism, tetanus, cirrhotic kidneys, "foreign body," pneumonia, degeneration of the heart muscle, or some other accidental complication. But although we may receive such statistical collections with a certain degree of reserve, it is nevertheless true that Tait attains at least as good results as the most strenuous advocate of antisepsis, and that if, as his recent publications claim, he has performed 65 successive salpingotomies without a fatal termination, his success is unique.

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[1] The articles by Tait, Thornton and Bancock on "Listerism in Abdominal Surgery" (*Amer. Journ. of Obst.*, 1884) strengthen our doubts of statistics, although we must regard as unfounded the charge of intentional deception with which one of the writers honors the other.

[2] It is very difficult to arrive at a just conclusion with regard to Tait's results. For example, while the results in hysterotomy given in his work on ovarian diseases are very favorable, Thornton states that, according to another publication by Tait, the latter had 5 deaths among 9 hysterectomies. But these were incomplete operations and are not found in the tables contained in Tait's book. The latter refers only to cases which were treated with his circular clamp. This illustrates our previous remarks concerning modifications of a method. While this book is going to press we have received the statistics of all of Tait's laparatomies. Among the 1,000 laparotomies are included 94 exploratory incisions and 80 incomplete operations !!

The subject may be briefly summarized in the following way. There are three principal methods of procedure:

1. Strict antisepsis, spray, neglect of toilette, the most rapid operation possible, no drainage.

2. No spray, no special attention to antisepsis, extremely careful toilette, relatively slow operation, comparatively frequent use of drainage.

3. Rejection of all disinfectant measures, careful toilette, occasional drainage.

Whether Tait attaches special importance to rapid operation does not appear from his publications. Probably he does not, inasmuch as repeated washing of the abdominal cavity, and removal of the fluid by means of sponges, in other words, careful toilette, always require a certain amount of time.

Among the three most successful laparotomists (with a large number of operations) Keith is the oldest. His good results extend over a long number of years, and are attested by detailed reports. The successes were obtained in extirpation of fibromata as well as in ovariotomies. Both the other operators furnish very meagre reports. Tait's success in salpingotomy surpasses that of all others, inasmuch as this operation is more dangerous than ovariotomy.

No other operators have obtained such results, although their scientific and technical attainments are, in many cases, undoubtedly equal to those of the operators previously mentioned. Perhaps a certain part is played by chance. If an operator has 3 per cent. mortality, he must have been very lucky, and it is not at all probable that the mortality should not be greater in the next hundred cases, on account of unforeseen influences and complications.

It is difficult to explain the striking fact that operations made in accordance with such different methods should be attended with such similar results, and that favorable results are obtained even when antisepsis is neglected.

Our antiseptic method has grown less complicated on account of our restriction of the number of assistants, instruments and utensils, but if we adhere to antiseptic principles it is not probable that it can be simplified much more. And yet we cannot be positive that the patient will escape infection or self-infection. If the case terminates unfavorably, it is said that some precaution has been neglected, and this can be shown to be true if we examine the matter carefully. But the neglect of some precaution might also be detected, if successful operations are examined. At the same time better results may be obtained by an operator who has discarded almost the entire antiseptic apparatus.

In our search for the causes of the varying results, we have been struck by one fact which may perhaps shed some light on the subject. Of the three most successful operators, two, Keith and Tait, are specialists *par excellence*. So far as I know they perform laparotomy alone, and have no large hospitals containing numerous patients with various diseases, but merely have wards for laparotomies. Prior to the antiseptic period, Keith performed very successful ovariotomies in a small private house, arranged for this special purpose. Tait operates very often in private houses.

So far as regards the attendants, I am not accurately informed, but Tait appears to have had the same assistant for many years. Martin is also in the same position as Keith and Tait. Although not so one-sided in his specialty, he has merely a small private clinic. But in myotomy and salpingotomy his antisepsis proves insufficient.

Hence the successful results, especially those of Tait and Keith, are explained by the condition of the operating rooms (free from pathogenic microbes), and also by the fact that these two operators carefully avoid contact with infectious patients and objects. The striking differences in the results do not seem to us to be explicable on the ground of greater scientific attainments, diagnostic skill and technical expertness in the operation. In certain particulars the superiority might even be claimed for others. The advantages enjoyed by these two operators have not been entirely replaced hitherto by so-called antisepsis. Let us hope that this may be attained. Otherwise the consequences would be very dreary, as we would degenerate into laparotomists, doubly dreary because the medical mechanic has even now become too prominent.

Perhaps further advances will antagonize this undesirable specialism. There is little doubt that definite pathogenic bacteria are the chief sources of trouble, while many other germs probably are not injurious to the abdominal cavity. We will probably learn more concerning the former, so that we will become able to render them innocuous. Or perhaps we will discover some remedy which, without injuring the peritoneum or the general economy, will destroy all infectious germs. Such a substance, employed in the form of spray or irrigation, or after the completion of the operation, to wash out the entire abdominal cavity, would enable us to complete the operation undisturbedly, to check hemorrhages, and then to thoroughly clean the abdominal cavity. The neglect of abdominal toilette, with the greatest rapidity of operation possible, can only be regarded as a makeshift which, while it seems to be not ill-founded, as regards the mortality during the first period of convalescence, has been shown to be followed later by decided bad effects, and even by a fatal termination. But the great stress laid by the strongest adherents of antisepsis upon the necessity of completing the operation as rapidly as possible, is the best evidence of their own incomplete reliance upon antisepsis. Experiments have been made with various remedies of this kind. None have proven entirely satisfactory, although complete protection against infection might have been expected, according to the investigations on the remarkably great antiseptic properties of corrosive sublimate, and of carbolic acid, which is again occupying greater prominence. But even the constant flooding of the field of operation with these substances, is not a sure protection against sepsis, and may give rise to very disagreeable symptoms of poisoning. Thymol has not met with a better fate.

We may also follow another plan, and attempt secondary antisepsis, with improvement of drainage. The good results obtained, in total extirpation of the uterus through the vagina, by means of the very simple capillary drainage with strongly absorbent iodoform or corrosive sublimate gauze (which is passed by some into Douglas's sac, and by others at least as far as the peritoneum) should be taken into consideration. It must also be remembered that Keith employs drainage very extensively, and this is also true, though to a less extent, of Tait's operation. To give up drainage entirely does not appear to us to be justified by the present condition of our art. If large masses of tissue have been seriously injured during the operation, or if they will probably become necrotic from other causes, for example, from the shutting off of the blood supply, and a hemorrhage ensues which can not be entirely checked, or if the condition of the patient demands rapid closure of the abdomen, while it still contains tough colloid cyst-contents, drainage cannot be dispensed with. Whether the opposite plan which relies entirely on primary antisepsis is more ideal, and should be looked upon as the method of the future, need not be considered. Doctrinarianism is as little applicable to this purely practical question, as it is in deciding on the advantages of intra-peritoneal or extra-peritoneal treatment of the pedicle in supra-vaginal amputation of the uterus.

In view of the apparently similar results attained by the three methods described, there is no reason for manifesting a general preference for one or the other, and to reject the others, together with their underlying principles. This may be done least of all with Keith's method, since it is the oldest, and has been tested for a long series of years.

In our opinion it is best to individualize, and according to the peculiarities of each case, to decide for careful toilette, rapid operation and closure of the abdominal cavity, or drainage. In some cases there can be no doubt as to the plan to be adopted. Tough colloid masses may no longer be left behind. In simple parenchymatous hemorrhage from a very extensive surface of adhesion (which, in some cases, can not be checked at all or only after a long delay) the abdominal cavity must be rapidly closed, if there is no other complication, and the hemorrhage checked by compression. When ichor, urine or fæces have passed into the peritoneal cavity, life, perhaps, may be saved by drainage alone. The latter has found few adherents in Germany, because the attempts with Sims's method have had such poor results, and because they have given rise to infection. Hence, it has also been considered dangerous to effect drainage with glass or hard-rubber tubes, which were passed through the abdominal incision into Douglas's *cul-de-sac*, and through which a strongly absorbent material, dipped into a disinfectant, was shoved (sometimes even into the peritoneal cavity). But this is by no means true, if the surrounding abdominal wound is properly disinfected. At least we have seen no bad results, and although we do not wish to assert that our object is always attained, nevertheless this has been accomplished in many cases. As this measure can be followed by few evil effects, if the precautions described in other chapters are adopted, we warmly recommend that fresh trial be made of a method which Keith so warmly recommends.

At all events the facts adduced necessitate caution in the selection of the locality for performing laparotomy. It would be best to perform the operation in a house remote from other hospitals, or at least in a building which is separated from the other wards of a hospital—special instrumentarium and other utensils, as a matter of course, and it would be very desirable to have special assistants. Clinics which admit surgical and gynecological patients of all kinds, and at the same time are used as a maternity hospital, are but little suited to the operation, unless they possess many separate wards or few patients.

The after-treatment of the patient must be as simple as possible. If infection has been avoided during the operation, the greatest danger is passed. Bodily and mental rest during the first few days is the most urgent requisite. After being properly cleaned the patient is carried into a warm bed, provided, if necessary, with fresh bed-clothes, and the limbs and trunk kept warm with warming-pans. The after-effects of narcosis are relieved by the ordinary remedies, .a little ice or stimulants subcutaneously. In conditions of collapse we give stimulants subcutaneously, enemata of wine, laudanum internally, when indicated, and if the condition of the stomach permits, brandy and water, tea, coffee or wine. The diet should be in fluid form, or at least very easily digestible. Stimulants should be given only in conditions of special weakness or to individuals who are accustomed to their use. We have not been able to convince ourselves of the necessity of the frequent, indiscriminate administration of stimulants, such as brandy, strong wine, etc., in the first period after the operation. The patients very rarely die of pure weakness, and in equally rare cases do we save a septicæmic patient by the aid of stimulants, although we consider their administration perfectly justifiable in such conditions. We may observe in some cases that such a patient lies in a condition of extreme exhaustion, with a miserable pulse of 130 to 140 a minute, and after the evacuation of a mass of ichor, the pulse and general condition improve as if by magic, although perhaps the patient is taking nothing. The cause of the weakness is rarely found in inanition, but in the poison which infects the organism. With regard to the administration of stimulants and nourishment, we think it is important to consider, *cum grano salis*, the feelings and desires of the patient. We have often seen better results from milk or sour milk than from the most concentrated nourishment and stimulants.

As soon as the condition of the patient permits, her position should be changed occasionally, for example, from dorsal to lateral decubitus. If this cannot be done, the nurse should flex and extend the lower limbs every hour or two at the hip, knee and ankle joints. This, together with an elevated position of the legs, exposure of certain parts, such as the calves and popliteal spaces, and a change in the points of support, is a good remedy against thrombosis. Remedies which increase the blood pressure, such as moderate doses of quinine, should be given in time to patients suffering from feeble heart's action.

Bed-sores are best prevented by a position in which the supporting surface of the body is as extensive as possible. When the patients can lie with the head and shoulders low, the trunk should be almost horizontal. The sacrum and the back as high as the shoulders then form the surface of support. The lower limbs may be elevated if we fear thrombosis, or do not desire tension of the abdominal walls. Otherwise, air-bags, water-bags, or change of position are the best remedies.

Vigorous local treatment, such as the application of cold compresses or an ice-bag, should not be instituted unless there are special indications. The general use of injections, and still more of constant irrigations of the vagina after operations, we regard as injurious rather than beneficial. In the first few days, while there is still hyperæmic swelling, they act as a mechanical, hurtful irritant. At a later period, and if the secretion is very copious and foul smelling, cleansing injections (the tube being introduced very gently and very slight pressure being used) are advantageous. But they are not often required.

In former times the patient was kept constipated for a long time after laparotomy. Tait was the first who strongly opposed this view. In ordinary cases he gives an enema on the third or fourth day, if the evacuation does not occur spontaneously. He has no dread of giving laxatives, even a few hours after the operation, and recommends, particularly in bilious vomiting, a Seidlitz powder, sulphate of magnesia or calomel. We have also abandoned the constipation plan, and find that the patients feel better without it. Perhaps thrombosis and even ileus may be prevented in this way. At all events adhesions are prevented or even separated and elongated. As a matter of course, it is better to follow the old plan, if there is great probability of the formation of a circumscribed abscess. Tait claims that laxatives facilitate the natural drainage of the peritoneum, and attributes his good results in part to their use.

The catheter should not be employed unless micturition becomes impossible. The necessary precautions are described in detail in the paragraph on instrumental examination of the bladder. A vesical catarrh, which is apt to ensue unless all precautions are adopted, may have an injurious effect on the course of convalescence, and even be attended with danger. Some patients are able to micturate if the hands are dipped in warm water. Cold water is occasionally of service. As a general thing, it is advisable not to catheterize after the operation, as is usually done. We have noticed that the patients pass the urine more readily if this has not been done.

The temperature of the room should be 13 to 15° R., and good ventilation should be secured. A draught is certainly injurious, especially if the current of air strikes the operated part or its vicinity. We must endeavor to obtain a uniform temperature and pure air without draughts.

The older physicians and obstetricians laid great stress on maintaining the natural secretions in puerperal women, and those who had undergone operations. The greatest importance was attached to the cutaneous activity. This notion has been again brought forward with regard to ovariotomy. The patient is prepared by means of baths, and an attempt is made to keep the skin turgescent, and to predispose it to perspiration. Although this preliminary treatment is not necessary in all operations, yet greater attention should be paid to this point, and diaphoresis stimulated by warm clothing, and by the injection of large amounts of lukewarm or cold drinks (not by elevation of the external temperature.)

CHAPTER III.

OPERATIONS ON THE OVARIES.

EXTIRPATION OF OVARIAN TUMORS.—OVARIOTOMY.

THE HISTORY AND STATISTICS OF OVARIOTOMY.

THE first rational attempts at ovariotomy date back to the beginning of this century, but it is only for the past twenty-five years that the operation is generally recognized as scientifically justifiable. The work imposed upon the pioneers of the operation was difficult in every direction. Not alone were they forced to grope slowly for the principles of the operation and to perfect its technique, but it first became necessary, at the cost of many disappointments in the dead-house and the sick room, to acquire better anatomical knowledge of ovarian tumors, and to learn the diagnosis of pelvic tumors.

The idea that the extirpation of dropsical ovaries might lead to permanent recovery, was first suggested by Schorkopf in 1685. During the 18th century the question was discussed by prominent physicians. In 1772 Hunter made the suggestion that, if there are no adhesions, the punctured sac should be extracted through an opening two inches long. But the first operations of which we have any knowledge were made unintentionally. Thus, in 1701, Dr. R. Houston exposed an ovarian tumor by an incision five inches in length, and as nothing escaped after puncture, he removed the colloid contents of the multilocular tumor in part with his hands, in part with a piece of wood shaving, and then closed the abdominal wound with three sutures. The patient recovered and lived for sixteen years. A few years later Salvator Morand performed total extirpation of an ovarian cyst, inasmuch as, in the attempt to withdraw the canula of the trocar, the entire cyst was removed. The patient died.

Ephraim MacDowell, of Virginia, was the first one to perform ovariotomy according to a well-considered plan, and in the full consciousness of what he was doing. It is said that he received the impetus to the operation from his teacher J. Bell of Edinburgh, who had emphasized the uselessness of all other methods of treatment, and believed firmly in the practicability of extirpation. MacDowell performed his first operation in 1809. The patient recovered and lived thirty-one years. He operated in twelve additional cases with eight recoveries.

The development of the operation is associated with the names of Atlee, Spencer Wells, Baker Brown, Koeberlé and Keith. Through the efforts of these men ovariotomy gradually received a scientific basis, its technique was improved to a high degree of perfection, and the last objections dissipated by the increasingly favorable results.

We will now give a brief *resumé* of the development of the methods of operation.

The first operators generally lost the advantage accruing from the diminution in the size of the tumor during the operation. MacDowell and others sometimes made enormous incisions, extending from the epigastrium to the symphysis. In 1836 Jeaffreson was the first to remove a large cyst through an incision only 1½ inches in length. Clay, on the other hand, preferred long incisions as a matter of principle.

The greatest changes were experienced in the treatment of the pedicle, upon which the main interest of the operation was long concentrated. MacDowell, Clay and others tied it with a ligature which was drawn out through the lower angle of the wound. Nathan Smith (1821) first ventured to cut the ligatures off short, and to allow these foreign bodies to remain permanently in the abdominal cavity. This simple method failed to receive recognition for a long time. It was first restricted to unfavorable, exceptional cases, in which other methods did not appear to be suitable, because the decomposition of the ligature and its inflammation-producing effect were dreaded. It is not until very recently that ligature of the pedicle *en masse*, based upon experiments on animals, and favorable results in the human subject, was raised to an undisputed, principal method.

In 1849 Stilling formulated the principle of extra-peritoneal treatment of the pedicle. The pedicle was to be fastened in the lower angle of the wound, and all the pathological changes on its raw surface were to occur outside of the abdominal cavity, under the eye of the physician. It was not until 1858 that it received general recognition under the form of Hutchinson's clamp treatment. This became epoch-making, from the fact that by it alone satisfactory results on a large scale were first obtained. At the present time it possesses only an historical interest.

Further important progress was made in 1865 by Baker Brown's removal of the pedicle with the actual cautery, a method which found an extremely fortunate advocate in the person of Keith.

In addition to these brilliant achievements in empirical and technical fields, we must note a series of important theoretical discoveries, which often furnished the subsequent scientific basis for the rapidly advancing empiricism. We refer to the testing, by means of experiments on animals, of the value of certain methods of operation, and of other points which are important as regards the result of the operation. Also, the advances in the anatomical knowledge and diagnosis of abdominal tumors, which have led, on the one hand, to more precise formulation of the indications; on the other hand, to the origin of new methods of operation.

The introduction of antisepsis has been of the greatest importance in the recent development of ovariotomy, and forms a mile-stone in its history. To German operators belongs the credit of being pioneers in its employment. Hegar has operated since the summer of 1875, according to his own peculiar method of antisepsis.

Keith did not accept antisepsis until March, 1877, Thornton in December, 1877, and Spencer Wells not until the beginning of 1878.

ANATOMICAL RELATIONS.

The ovarian tumors, which have been the subject of operative interference, are in part epithelial (colloid and dermoid cysts, carcinoma), in part desmoid (fibroma, papilloma, sarcoma, myxoma). They are quite often mixed forms, in which larger or smaller portions of the cyst walls present a myxomatous or sarcomatous character. In like manner there may be combinations of carcinoma and cystoma, or malignant degenerations of primarily benign cystomata.

Olshausen has recently called attention to a peculiar form of proliferating cystoma, which looks externally exactly like a cauliflower growth.

Malignant tumors and dermoid cysts are much more frequently bilateral than simple proliferating cysts. A separate position, from a clinical and anatomical standpoint, is taken by certain bilateral papillary cysts, which are situated entirely within the broad ligament, and whose papillary excrescences occasionally grow into the bladder and other adjacent organs.

The only solid tumors are the fibromata, and occasionally sarcomata and carcinomata. The majority of ovarian tumors contain larger or smaller cavities, filled with fluid, and may, therefore, be diminished in size during the operation.

This diminution is most marked in unilocular cysts or multilocular cystomata, with a predominant main cyst, while honeycomb-like tumors, composed chiefly of solid material or solid tumors, necessitate a larger incision.

At first ovarian tumors are usually situated behind or to the side of the uterus, and push it forwards or to one side. As their growth increases they either drag it up towards the abdominal cavity, or push it deeper into the pelvis, or even to the outside. In the abdominal cavity ovarian tumors are applied closely to the anterior abdominal wall, and push the intestines upwards, backwards or to the side. In very exceptional cases, adherent loops of intestines are situated in front of an ovarian tumor. On the other hand the abdominal walls may be removed from the tumor by abundant ascitic effusion.

Ovarian tumors are almost always connected with the broad ligament and uterus by a band-like pedicle of varying length. It is composed of a portion of the broad ligament, the ovarian ligament and usually the tube, a longer or shorter portion of which is applied to the surface of the tumor. But in some cystomata and particularly in solid ovarian tumors, the tube does not form part of the pedicle. Its fimbriated extremity alone extends to the tumor, and may therefore be left behind during the operation.

The vessels of the pedicle are derived from the internal spermatic artery and from branches of the uterine artery; the former pass along the infundibulo-pelvic ligament, the latter along the median border of the uterus to the pedicle. The arteries are sometimes as thick as a raven's quill, the veins as thick as the little finger. Long, thin pedicles usually contain fewer but larger vessels than short, thick pedicles. The pedicle also contains numerous lymphatics and nerves, fibrillated connective tissue, and sometimes smooth muscular fibres. In some cases the round ligament passes into the pedicle, even in a double knot. Nussbaum, Spencer Wells and Werth mention double pedicles, which develop from the formation of a fissure in the broad ligament, between the ovarian ligament and tube, or between both these structures and the infundibulo-pelvic ligament.

The pedicle is sometimes brittle, particularly in malignant tumors, torsion, or fatty degeneration of the connective tissue and vessels.

Torsion of the pedicle is a very serious phenomenon. It is generally twisted ½ to 2 times upon its axis, but 5 to 6 twists have also been observed. If it developes rapidly it gives rise to severe circulatory disturbances: venous stasis with secondary hemorrhage and œdematous swelling, and also inflammation or even gangrene of the tumor. In slowly developing torsion the tumor gradually shrivels or its connection with the pelvic organs is entirely lost, and it is nourished by adhesions to the omentum, mesentery or abdominal walls. This rare process has been termed transplantation. Spencer Wells operated successfully in two cases, one of them a dermoid cyst.

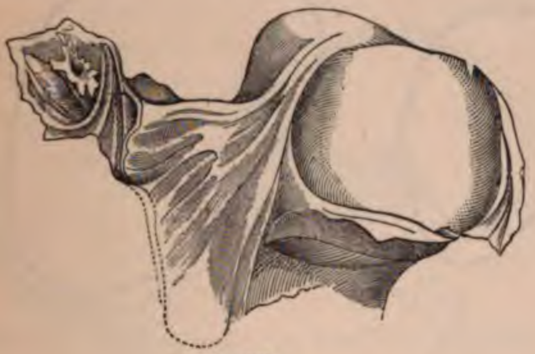

FIG. 102.

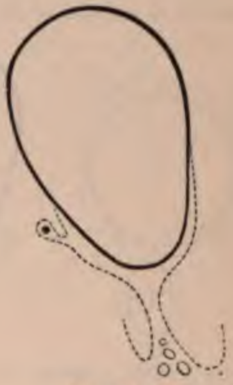

FIG. 103.

Small tumors are not infrequently destitute of a true pedicle. The normal connection of the ovary with the broad ligament is widened, to correspond to the size of the tumor. This is observed with comparative frequency in solid tumors. They are then held merely by a broad but very short reduplication of the peritoneum; this possesses some resemblance to a pedicle, because the hilus of the ovary forms a more or less deep groove. Finally, the pedicle may be wanting if the tumor, in its development, pushes in between the folds of the broad ligament (Fig. 102). A part of the tumor is then situated within the peritoneal cavity, the other is extra-peritoneal between the unfolded layers of the broad ligament (Fig. 103). The more this unfolding progresses laterally, the nearer the extra-peritoneal segment of the tumor approaches the lateral pelvic wall, or, after the infundibulo-pelvic ligament is unfolded, even the iliac fossa. In the median line it comes in contact with the uterus (Fig. 104), whose peritoneal covering it may even displace backwards and thus push its way beneath the broad ligament of the opposite side. The vessels are not collected in a narrow band, but are separated from one another, and enter the tumor mainly in two bundles, the uterine vessels on the median side along the tube, the spermatic vessels to the side of the linea terminalis (Figs. 104 to 107.)

The unfolding of the broad ligaments may also vary in the downward direction, *i.e.*, the folds of the ligament may reunite immediately below the tumor (Fig. 103), so that only a few narrow veins shimmer through, or the unfolding is so complete that the tumor pushes deep into the parametrium and extends to the immediate neighborhood of the pampiniform plexus (Fig. 105) and even of the ureter.

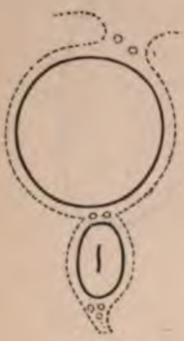
FIG. 104.

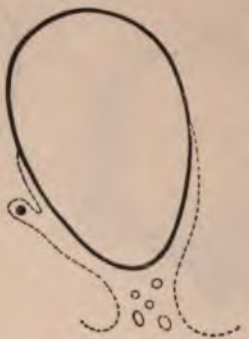
FIG. 105.

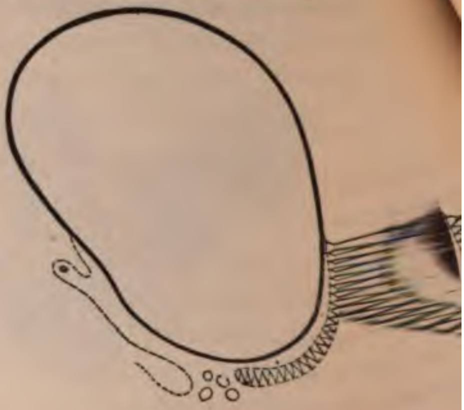
FIG. 106.

Indeed, Olshausen observed a bilateral papillary cystoma, whose extra-peritoneal segment extended between the rectum and vagina, to the neighborhood of the anus. The relations become very complicated when the outer surface of the broad ligament, which has been stretched by the tumor, undergoes secondary adhesions to adjacent parts of the serous lining of the pelvis (Figs. 106, 107). The proper interpretation of such conditions is not alone difficult during an operation, but even on autopsy.

In some cases one fold of the broad ligament is unfolded to a much greater extent than the other. A stage is soon reached in which the ligament is no longer able to cover the tumor entirely. If this occurs anteriorly, the extra-peritoneal portion of the tumor lies immediately behind the muscular layer of the abdominal walls, and the point at which the peritoneum passes to the latter is pushed upwards, even to the neighborhood of the umbilicus. If the posterior layer of the ligament is the part which is mainly unfolded, the tumor extends on the left side beneath the mesocolon of the sigmoid flexure, on the right side beneath the mesocæcum, and in both events in the immediate neighborhood of the large iliac vessels. Even the mesentery of a loop of small intestines may be unfolded, and the tumor, which is chiefly retro-peritoneal, may extend to the region of the kidneys.

At first the surface of most ovarian tumors is perfectly smooth. But after a time purely mechanical causes often give rise to desquamation of endothelium and partial peritonitis, which terminates in more or less extensive adhesions. These are sometimes the result of primary inflammations of the cyst wall. At first such adhesions are usually spread out along the surface. On account of the continued growth of the tumor, and the influence of respiration or the movements of the intestines they are often drawn into membranous bands or more or less thick cords. In rare cases they consist entirely of vessels which course free through the abdominal cavity.

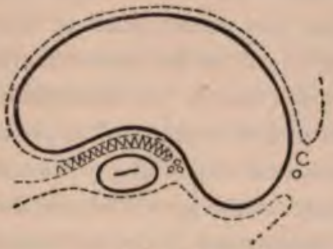

FIG. 107.

Adhesions to the anterior and lateral abdominal walls, the omentum and intestines, are found most frequently; next follow adhesions to the uterus, bladder, linea terminalis, Douglas's sac, mesentery, liver and gall bladder, diaphragm, stomach and spleen. The surface of the pedicle may also become adherent to adjacent parts, especially the serous lining of the pelvis, also the small intestines and vermiform process.

Instead of the development of adhesions serous effusions may become prominent as the expression of the mechanical irritation of the peritoneum. Ascites is unusually abundant in solid and especially malignant tumors. Its character (admixture of blood or constituents of the tumor) may be important in deciding for or against an operation.

Among the pathological processes in cysts, which may play a part among the indications for operation, may be mentioned hemorrhages into the cysts, suppuration, gangrene, perforation, and torsion of the pedicle. Some of these processes, such as perforation and torsion of the pedicle, may result in a sort of spontaneous cure. Destruction of the epithelial lining and consequent disappearance of the cysts have also been observed especially at an advanced age, after fatty degeneration, calcification, sclerotic thickening of the cyst walls.

INDICATIONS AND CONTRA-INDICATIONS OF OVARIOTOMY.

In extremely rare cases ovarian tumors have no appreciable influence on the health, because they remain small or undergo more or less complete natural recovery by one of the above-mentioned processes. By far the larger majority of the tumors very soon endanger the health and life of the patients on account of rapid growth, pressure on adjacent organs, peritonitic processes, ascites, or pathological processes in the tumor itself. The anatomical character of the growth usually determines which of these sequelæ occupies the foreground in the individual case, and chiefly leads to active interference on the part of the physician. In proliferating cysts it is chiefly the rapid growth and the compression of adjacent organs, in solid tumors the often very considerable ascites, in dermoid cysts the suppuration of the tumor and the accompanying peritonitis.

The more accurate our knowledge of the histogenesis of ovarian tumors has become, the stronger has the conviction grown that the large majority of proliferating cysts and all solid and semi-solid tumors can be radically cured by extirpation alone.

Other operations, such as puncture, drainage, injection of iodine, are only applicable in simple cysts, and even here they are extremely uncertain, take up a good deal of time, and are decidedly more dangerous than extirpation. As a radical cure ovariotomy is therefore preferable to all other methods, and the latter need only be considered in exceptional cases.

From this standpoint there can be a difference of opinion merely with regard to the proper time for operation, and to defining the limits of those cases which furnish a permanent or temporary contra-indication.

The opinions of operators vary considerably with regard to the proper time for operation. Some advise extirpation as soon as the diagnosis is made. They start from the view that life will be endangered sooner or later, and regard an early operation as favorable, because the tumor, if small and free from adhesions, may be removed through a short incision.

The other extreme is represented by those who recommend ovariotomy only after very marked symptoms have developed, or when the tumor, on account of its size, has given rise to dangerous disturbances of function.

The experience of to-day decidedly supports the early operation, before the general condition is materially impaired and before torsion of the pedicle threatens danger, or intercurrent peritonitides have given rise to extensive adhesions.

On the other hand it is not justifiable to disregard entirely the severity of the symptoms and the size of the tumor in determining the time of operation.

The technical difficulty and thus, indirectly, the danger of the operation, are greater in small tumors which are not yet in contact with the anterior abdominal wall or do not float in a corresponding amount of ascitic fluid. The often broad connections with the pelvic organs cannot be sufficiently exposed, especially if the abdominal walls are tense, while a better unfolding of the broad ligament may occur after a time, and thus a more favorable development of the pedicle. If there is no urgent necessity it is therefore better to wait until the tumor reaches the level of the umbilicus, and smaller tumors are only extirpated when violent pains or symptoms of compression of the pelvic organs compel early interference. But the symptoms may be very marked even at the beginning of the development of the tumor, and may thus constitute an early indication for castration.

The choice of the time of operation is also influenced in many cases by external circumstances. Women who belong to the laboring classes, or girls who dread the suspicion of pregnancy, will, as a general thing, be subjected to an earlier operation than widows who are the sole support of little children, etc.

Certain rare conditions demand immmediate operation in order to save life. These include hemorrhage into the cyst or abdominal cavity, such as occurs after puncture or torsion of the pedicle; acute peritonitis, suppuration or gangrene of the tumor, uræmic symptoms or signs of intestinal occlusion, attributable to compression by the tumor or to constriction by bands of adhesion or the twisted pedicle.

Acute peritonitis, from the escape of tumor contents after spontaneous rupture or puncture, may place the patient in immediate danger. Extirpation of the tumor and cleansing of the abdominal cavity may save the patients, if the extravasated contents have not possessed intensely infectious properties. Keith was the first who ventured to operate during a peritonitis which had followed puncture; the patient recovered. The propriety of this indication has since been proven by numerous cases. Peritonitis after torsion of the pedicle generally runs a less threatening course, so that, as a rule, immediate interference is not required. But even in such cases the operation may not be delayed too long after the cessation of the first symptoms of inflammation, since otherwise the loose adhesions will become too firm.

The results of ovariotomy in acute suppuration or gangrene of the cyst are more favorable than in peritonitis. With the removal of the morbid focus, the fever disappears forthwith in many cases, or the sub-normal temperature becomes normal immediately after the operation. It is noteworthy from a diagnostic standpoint that the physical signs may change suddenly after gangrene of the cysts as well as after rupture. The fluid extravasated into the abdominal cavity furnishes the signs of free exudation (dull percussion sound in the lumbar regions), while the formation of gas in the cysts may give rise to a tympanitic percussion note.

The operation is contra-indicated when it is attended with too great dangers, which are entirely disproportionate to the chances of success.

1. For example, in intra-ligamentary tumors which are indissolubly connected with surrounding parts, especially in the case of bilateral papillary cystomata. Complete extirpation may then be technically impossible, or it presents hardly any prospect of success on account of the large extent of the intra-ligamentary wound surface and the impossibility of thoroughly checking the hemorrhage. The unfavorable insertion of the tumor may usually be foretold with complete certainty by an anal examination. But sometimes we do not gain a clear conception of the anatomical relations and the impossibility of operation until the abdomen has been opened. The modifications of the operation required in such cases will be discussed later.

Parietal and intestinal adhesions *per se* never contra-indicate an attempt at extirpation. On the other hand the operation may be prevented in the case of malignant tumors, by the fact that the adhesions are very extensive and are associated with great brittleness of the adherent organs.

2. In malignant tumors which have extended to the peritoneum or adjacent organs, or have given rise to metastases in remote organs (stomach, intestines, etc.) Particular attention must be paid in this regard to enlargement of the inguinal glands and of the hypogastric and inferior lumbar glands, to distinct nodules adjacent to the main tumor, and to the presence of constituents of the tumor in a co-existing ascites. If dissemination on the peritoneum is not demonstrable, and the adjacent lymphatic glands are intact, an operation is indicated even in undoubtedly malignant cases, if the tumor is freely movable, or if there is immediate danger to life from suffocation or uræmia, as the result of extensive ascites. If such tumors are immovable, there is hardly any chance of success, because the disease has usually extended to the parietal and visceral peritoneum. It must be remembered that in not a few cases the malignant character of the tumor does not become apparent until the operation, or perhaps not until a microscopic examination of the preparation has been made.

Hitherto the results of operation in malignant diseases of the ovary have been very unsatisfactory. Few patients survived the operation more than a few months to a year. Billroth has reported a unique case, in which both carcinomatous ovaries were removed, together with a portion of the adherent wall of the bladder, and a piece of small intestine 12 cm. long, and in which no relapse had occurred at the end of fifteen months.

3. In acute febrile diseases, which have no connection with the presence of the tumor; also in those chronic general diseases, which, *per se*, would soon give rise to a fatal termination, and in which a favorable influence on the course of the disease, or a marked amelioration of the symptoms, could not be expected from the removal of the tumor.

4. The age of the patient is at no time a contra-indication. Ovarian tumors have been removed successfully in children of three years, and in women of seventy-eight years. Well-marked senile marasmus may form a contra-indication.

A question of the highest practical interest is the treatment of ovarian tumors complicated with pregnancy.

The cases in which the tumors exercise no injurious effects on pregnancy and parturition are not numerous. This is true only of small tumors and of those thick-walled cysts of moderate size which have remained stationary for years. Such tumors may be let alone.

In unilocular cysts, or tumors with a predominant cyst, relief is often afforded by simple puncture, if the symptoms are merely the result of marked distension of the abdomen.

On the other hand, puncture may be ineffective or even dangerous in large solid or multilocular tumors, and in those which possess infectious contents (dermoid cysts, suppurating cysts.)

If dangerous compression of the abdominal or thoracic viscera, and fever, occur in such cases, or if rupture threatens, we can only choose between the production of premature delivery and extirpation of the tumor.

The former plan has been recommended mainly by obstetricians, but it by no means guards against the dangers which may result from the action of parturition and the puerperal state upon the tumor (hemorrhage, rupture, suppuration of the tumor, etc.). Furthermore, if the extirpation of the tumor becomes unavoidable at a later period, the patient is exposed in quick succession to two dangerous operations, *viz.*, the induction of premature delivery and ovariotomy. It is, therefore, best to restrict the production of abortion to those cases in which the tumor, which is partly or wholly impacted in the pelvis, leads us to apprehend serious interference with delivery, while ovariotomy is shunned on account of unfavorable (intra-ligamentary) insertion, and puncture on account of the dangerous contents of the tumor.

Ovariotomy has been performed during pregnancy in numerous cases, and these prove that the danger of the operation is barely increased on account of the existence of pregnancy. The majority of the patients carry the fœtus to full term. Abortion occurs in about 40 per cent. of the cases.

During pregnancy conditions develop not infrequently which require immediate operation. For example, rupture of the tumor or torsion of pedicle, events whose occurrence is favored by the existence of pregnancy. A fatal termination has been observed as the result of torsion of the pedicle, peritonitis, perforation, and ileus (twisting of the intestines around the pedicle).

Spencer Wells operated successfully in a case of rupture during the fourth month, Schroeder in a case of suppuration of the cyst after puncture, with coincident prolapse of the gravid uterus.

If we are free to select the time of operation, the first months of pregnancy should be chosen, because at a later period the broad ligament is unfolded in such a way, and is so full of dilated veins, that the treatment of the pedicle becomes more difficult and dangerous.

Ovariotomies have been repeatedly performed when the existence of pregnancy was unknown. Indeed, the real condition of affairs has sometimes been overlooked during the operation, the pregnant uterus regarded as a second diseased ovary and punctured. In a case of this kind Spencer Wells was compelled to empty the punctured uterus, because the fœtus pushed through the gaping puncture and the uterine walls were torn in the attempt to replace it. The fœtus was then removed and the uterine wound closed with a continuous silk suture. The patient recovered. Similar successful cases have been reported by Hillas, Lambert and Byford. On the other hand a fatal termination occurred in all those cases in which the uterus was not emptied but simply sewed up. Spencer Wells mentions two cases, one of which is probably the one published by Pollock (*Med. Times*, September 13th, 1862). Abortion occurred soon after the operation, and death followed in two days. Erskine Mason also reports a case in which the uterus was injured during perforation through the abdominal walls; laparotomy, uterine wound sewed with catgut, death eighteen hours later after previous abortion. Hence it seems more advisable to empty the injured uterus, or even to remove the torn organ, inasmuch as injuries of the pregnant uterus exhibit the greatest tendency to tear still further on the occurrence of pains, and the fœtus then passes into the abdominal cavity.

PREPARATIONS FOR THE OPERATION.—INSTRUMENTS.

If the operation need not be performed on account of dangerous complication, there is time for certain preliminary treatment. A few lukewarm baths are taken, the vagina is disinfected, the bowels emptied by means of enemata and laxatives, and diuresis regulated. On the day before the operation a few doses ((gr. vij.) of bismuth, to which a little acetate of morphia has been added, are given in order to relieve distension of the intestines with gas.

Catarrh of the respiratory tract requires careful treatment, because coughing spells after the operation may interfere very materially with the progress of recovery. In very marked distension of the abdomen Spencer Wells and others have performed preliminary puncture, in order to improve respiration and diuresis by relieving the lungs and kidneys. At the same time this prevents the sudden diminution of pressure on the abdominal vessels, which might otherwise give rise to cerebral anæmia and collapse during the operation.

The operating room should be large, light and airy, its temperature from 19 to 22° C. Greater heat, especially if moist, is very annoying to the operator, and of no benefit to the patient.

The instruments used are a catheter, scalpels, forceps (Hegar's push forceps, Koeberé's or Péan's hæmostatic forceps) scissors, blunt hooks, forceps for fixing the tumor, Déchamp's needles, silk, catgut, elastic ligatures of various sizes, needle-holder, needles, sponges, and sponge-holders.

From the standpoint of antisepsis chief importance is to be attached to the greatest possible simplicity of the instrumentarium. Complicated instruments and those with wooden handles are to be avoided. Wood is not alone capable of imbibition, but impure substances are very apt to settle in the grooves between the handle and metal.

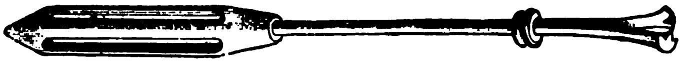

FIG. 108.

All the instruments mentioned above may be made of one piece or of a few pieces of metal which are easily put together. They may be nickel-plated as a protection against the action of disinfectant fluids.

Metallic instruments are easily cleaned and may be disinfected by means of dry heat. In Fig. 108 is shown a sponge-holder which, with the exception of the small movable ring, is made of a single piece of nickel-plated steel.

Many operators use the knife exclusively in order to empty the tumo while the trocar was formerly regarded as indispensable for this purpos The calibre of some of them was so large that even thick contents wou flow through. The trocars most in vogue were those of Thompso Koeberlé (Fig. 109) and Spencer Wells (Fig. 110). Some were provid with hooks or spring clamps to grasp the cyst wall and facilitate its withdrawal. The clamps formerly employed for extra-peritoneal treatme

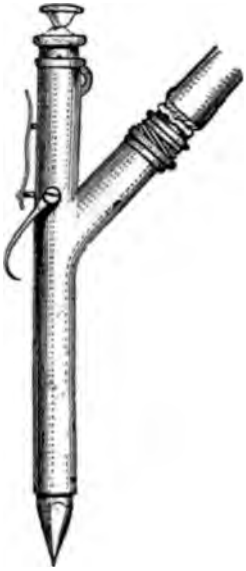

Fig. 109.

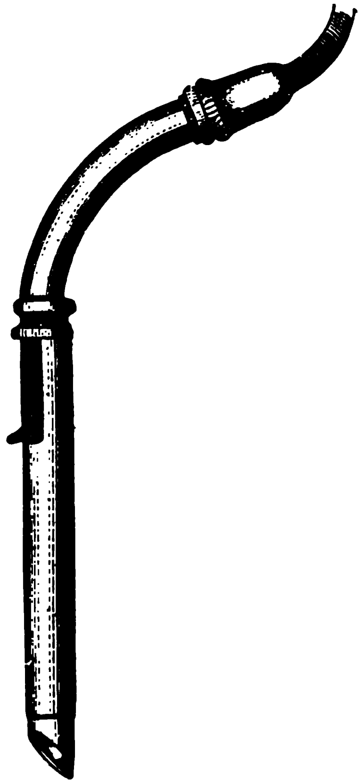

Fig. 110.

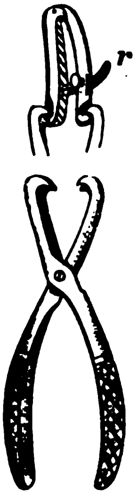

Fig. 111

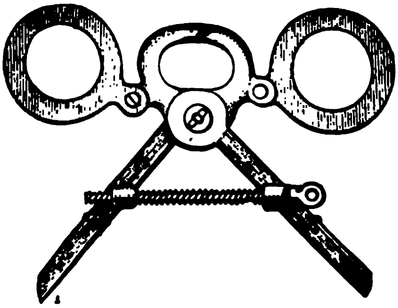

Fig. 112.

of the pedicle have merely an historical interest. It is for this reason alone that we furnish illustrations of Spencer Wells's clamps and closure forceps (Fig. 111) and Koeberlé's instrument with its spectacle-shaped appendage for pushing down the abdominal walls (Fig. 112). Forceps with broad quadrangular or round blades are used to draw out the cysts. They do not tear the wall, and, if necessary, may be employed to close the puncture. The inner surface of Nelaton's forceps (Fig. 113) has, in addition to transverse ridges, short spikes on one blade which fit into corresponding openings in the other blade. Other forceps are simply ridged upon the inner surface. Koeberlé's adjustable hook forceps (Fig. 114) or Péan's massive instrument (*vide* Myomotomy) are better adapted for firm tumors.

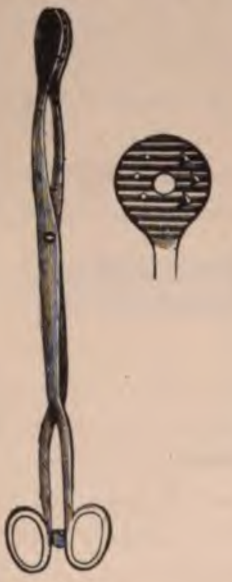

FIG. 113.

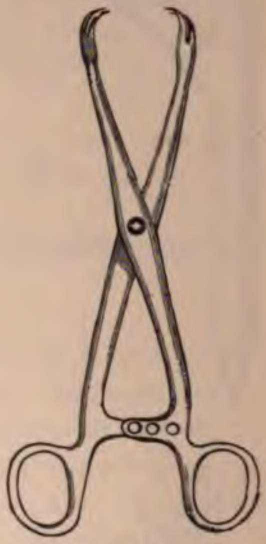

FIG. 114.

Some operators employ special clamps with broad surfaces of compression (cautery clamps) for cauterizing the pedicle. These are lined on the side nearest the abdominal walls with a poor conductor of heat, such as ivory (Baker Brown, Fig. 115) or soapstone. On the opposite side the Baker Brown clamp has a raised notch along which the cautery is introduced. This somewhat massive instrument may easily be made of smaller dimensions.

Any narrow, sufficiently long and high table, upon which the patient lies extended, may serve as an operating table. The operator and assistants then stand opposite one another. Koeberlé operates upon the bed in which the patient remains, but this is less desirable, as uncleanliness cannot be entirely avoided.

Hegar employs the operating table shown on page 9. The patient is drawn down until the pelvis reaches the lower end, while the separated legs are wrapped in woolen cloths and fastened in the grooves set apart for them. The trunk may be more or less elevated, according to the depth of the respirations and the vigor of the heart's action.

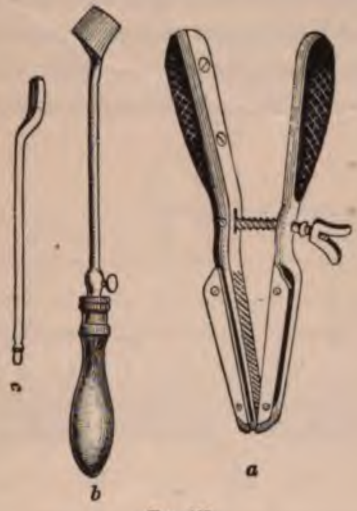

FIG. 115.

If the operating room is not lighted from above, the lower end of the table is placed in such a way that the light from the window enters to the right of the operator.

Two or three assistants are required. One stands at the patient's head and administers the anæsthetic. A second assists the operator in exposing and cleaning the field of operation, in ligaturing, and in keeping back the intestines. In complicated operations a third assistant may be employed in lifting up and steadying a heavy tumor, and in holding instruments. The chief assistant stands opposite to the operator or to the left of the patient (Fig. 2.)

One nurse attends to the handing and cleansing of the sponges and changing the water, another threads the needles. All the instruments which are to be used during the operation are well cleaned and disinfected the night before, placed in a Koch sterilizing chamber, and heated to 140° by means of a gas jet. They are not removed until immediately before the operation and are then placed in shallow porcelain dishes filled with a 2½ per cent. solution of carbolic acid. These are placed to the right of the operator, so that they can be readily removed and replaced. In addition, vessels containing disinfectant fluids for cleansing the hands are kept at the disposal of the operator and assistants.

The silk is rolled on glass cylinders, and kept in a glass case which is filled with a disinfectant fluid, for example: 1:1000 of corrosive sublimate. Each series of threads is drawn out through a special groove (Fig. 116) immediately before it is used. The sponges are kept in a solution of carbolic acid (1–1½:100) or corrosive sublimate (1:5000–10,000).

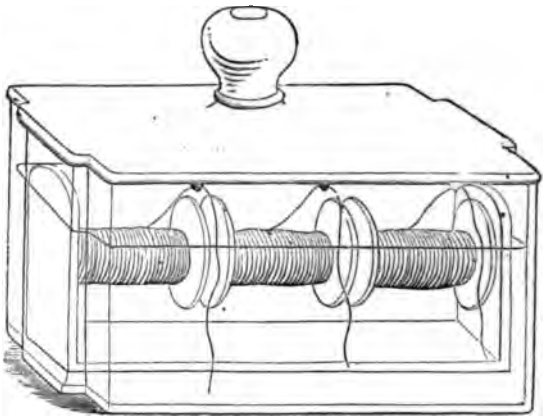

FIG. 116.

The patient is dressed for the operation in clean stockings, chemise and flannel jacket; the two latter are rolled up and covered with india-rubber cloth to prevent wetting.

The choice of anæsthetics is important. As a rule, we employ chloroform. Spencer Wells extols bichloride of methylene, because it is less apt to produce vomiting. We were unable to verify this statement, and believe that much depends upon the mode of administration of the remedy. When profound narcosis was quietly induced, we were rarely disturbed by the protrusion of loops of intestines, etc. Ether has given very satisfactory results in exhausted individuals with weak heart's action but normal respiratory organs. In such cases chloroform is apt to cause syncope. The very disagreeable effect upon the operator and assistants is an obstacle to the regular administration of ether.

In order to prevent vomiting the last meal prior to the operation (1 to 2 hours) should consist merely of a cup of *café noir*. Beginning narcosis may be utilized for the final preparations—soaping and disinfecting the abdominal walls, shaving the *mons veneris*, antiseptic irrigation of the vagina, catheterization. The anæsthesia must be profound in order to prevent, by complete elimination of abdominal pressure, protrusion of the intestines.

OPENING THE ABDOMINAL CAVITY.

It is best to open the abdominal cavity in the linea alba, as no important vessels can be wounded here, no muscle sheaths opened, and equally free access can be obtained on either side. In a second laparotomy on the same patient the incision is made 2 to 3 cm. from the first, and parallel with it, on the side of the diseased ovary.[1]

The following layers must be incised in the linea alba: skin, subcutaneous cellular and adipose tissue, the linea alba, *i.e.*, the united aponeuroses of all the broad abdominal muscles, the fascia transversa with its cellulo-fatty præ-peritoneal tissue, peritoneum. The obliterated urachus is sometimes found in the median line but is readily pushed to one side. But its obliteration is not always complete. Spencer Wells found uratic concretions in the canal (which was closed at both ends), and Pernice even observed open communication with the bladder.[2]

The thickness of the abdominal walls in the linea alba varies very considerably. In very large tumors it is occasionally as thin as a membrane, in very obese individuals or if there is considerable œdema it may be more than 6 cm. thick. The skin between the umbilicus and symphysis is thicker and firmer than that between the umbilicus and ensiform process. At the umbilical ring it is firmly held by connective tissue which is destitute of fat. If the incision is made through the rectus the other layers present are: the sheath of the rectus, composed of the aponeuroses of the external and internal oblique and transverse muscles, and the rectus itself. The blood-vessels of the anterior abdominal wall are derived from the superior epigastric, a branch of the internal mammary, and the inferior epigastric, a branch of the crural. They usually anastomose in the median line by fine branches. An abundance of vessels in the line of incision almost always indicates recent peritonitis or malignancy of the tumor; but the veins may also be very large as the result of simple stasis.

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[1] Storer makes an incision through the rectus, parallel to the linea alba, because he believes that the muscle is better adapted to union by first intention than the linea alba. Other methods of incision possess merely an historical interest.

[2] *Deutsch Med. Wschr.*, 46, 1878. On the seventh day after the simple operation urine began to trickle from an extremely fine fistulous opening alongside the pedicle, which was fastened extraperitoneal.

When the abdomen is tense, the first incision is made free through the skin and subcutaneous tissue. When the abdominal walls are very flabby, as, for example, after puncture, they may be lifted into a fold, the latter incised at its base and the incision then followed upwards. Large veins are avoided by turning a little to one side. Transverse vessels receive a double ligature before being cut. Special attention must be paid to large veins in the umbilical region, as they communicate occasionally with an unobliterated umbilical vein. Small arteries are provisionally seized with forceps, and twisted or ligatured. Every notable hemorrhage must be checked completely before opening the abdominal cavity.

If the recti are in close apposition, or the linea alba does not correspond exactly to the median line, the sheath of the rectus will be opened despite all precautions. If we are unable to find the inner border of the muscle quickly and to draw it to the outside, further traction and contusion of the edges of the wound should be avoided, and an incision should b made through the rectus parallel to the course of its fibres.

A free incision may be made through the linea alba, but afterwards is advisable, at least for the beginner, to make the dissection by layer As soon as the peritoneum, after incision through the occasionally ve fat præ-peritoneal connective tissue, is exposed, it is raised between tw forceps or with Spencer Wells's hook (Fig. 117), and a small incision made. The opening is then enlarged with the scissors or knife until tw fingers can be introduced. With these the non-separated tissues ar lifted up from the tumor and a free incision made through them equal i length to the cutaneous incision.

It is not always easy to recognize the layers which have been cut. For example, we may think that the peritoneum has been opened because the præ-peritoneal cellular tissue, which is loosely connected with surrounding parts, looks like the omentum, or because the peritoneum, being distended by ascitic fluid, protrudes like a thin walled cyst. When there are extensive adhesions the peritoneum is apt to be regarded as the cyst wall and is often separated from the transverse fascia and muscular layer of the abdominal walls. As soon as the mistake is recognized, a deeper incision should be made, or the incision prolonged beyond the boundaries of adhesion. On the other hand the adherent tumor may be opened because it is mistaken for the peritoneum. It is especially difficult to recognize the peritoneum when it has been very much thickened by chronic inflammation. Indeed there are cases in which, even after the peritoneum has been incised and a large amount of fluid has escaped, it is difficult to decide whether we have opened an encapsulated peritoneal exudation or a cyst which is adherent on all sides.

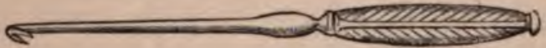

FIG. 117.

After the peritoneum has been opened, the tumor, if it is not surrounded by adherent portions of the intestine or omentum, appears as a bluish translucent body, of a silky sheen, which moves synchronously with respiration. A few drops of ascitic fluid almost always escape after opening the peritoneal cavity.

The necessary length of the incision cannot always be determined before the operation. In unilocular cysts, or if there is a predominant main cyst, an incision a hand's breadth in length, extending from below the umbilicus to 2 cm. above the symphysis, will often suffice.

Multilocular tumors, those which are solid in the main, and adhesions, often necessitate considerable enlargement of the incision upwards. The prolongation passes to the left of the umbilicus, in order to avoid injury to an open umbilical vein in the round ligament of the liver.[1]

As the length of the abdominal incision *per se* does not affect the danger of the operation, it should be made sufficiently long in each case to permit complete exposure of the field of operation and rapid removal of the tumor.

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[1] In cases of umbilical hernia the incision is made directly through the umbilical opening, and after excision of the protruding peritoneal sac, radical cure is attempted by careful sutures.

PUNCTURE, DIMINUTION IN THE SIZE OF THE TUMOR, SEPARATION OF ADHESIONS, REMOVAL OF THE TUMOR

If the exposed tumor contains cystic cavities, a knife is introduced or one of the above-mentioned trocars, whose rubber tube passes into a vessel placed beneath the operating table. If a large cyst has been entered the size of the tumor rapidly diminishes, and an assistant presses the abdominal walls, with the palms of his hands, against the collapsing tumor, in order to prevent the protrusion of intestines or the entrance of the contents of the cysts into the abdominal cavity. To prevent the latter accident the puncture must also be watched, and, if necessary, sponges or cloths applied to its vicinity.[1] Puncture greatly facilitates the further withdrawal of the tumor. If the cyst contents escape freely, and the tumor is not adherent, it is readily drawn out of the abdominal cavity with the aid of forceps.

A number of cysts must not infrequently be punctured in order to produce sufficient diminution in the size of the growth. Tumors containing small honeycomb-like cavities or very tough fluid, are divided by a long incision, the hand is then introduced and tears through the partitions between the individual cysts, and removes the colloid contents.

Solid tumors require a longer incision. Attempts to destroy the tumor with the hand, or to diminish its size by the excision of wedge-shaped pieces, render the operation unclean and give rise to considerable loss of blood. They are entirely unnecessary.

In the majority of cases adhesions must be separated before the tumor is removed. Whenever possible this should be done with the aid of the sense of sight. To pass the hand, before puncture, between the tumor and abdominal walls, and to separate extensive adhesions with more or less force, is entirely wrong. We are then apt to wound large vessels from which blood often escapes unnoticed into the deepest parts of the peritoneal cavity. If the tumor is adherent in the immediate vicinity of the abdominal wound, we should at first separate the adhesions only to an extent which will permit us to grasp the wall of the sac after puncture, and to see distinctly, by throwing back the abdominal walls, any hemorrhage which may occur. Further adhesions are only torn after puncture, after which the tumor can usually be drawn gradually into the wound.

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[1] Péan employs for the emptying of the tumor a simple trocar whose long rubber tube is connected with an air-pump at some distance from the operating table. By means of vigorous aspiration the contents of the tumor are removed without soiling the field of operation in the least.

Recent broad adhesions to the abdominal walls often yield to moderate traction, or the innumerable thin threads are separated with the handle of the scalpel or by stroking movements of the tips of the extended fingers. The nipping and crushing of band-like adhesions has also been recently recommended. Very firm and old adhesions are cut with the scissors or knife, and the bleeding vessels must be tied or acupressure performed. If there are circumscribed firm adhesions Péan cuts the previously loosened cyst wall free from the abdominal walls, and subsequently loosens the part which has remained *in situ*. Very vascular band-like adhesions may be grasped in a cautery clamp, and the Pacquelin cautery applied.

Omental adhesions are found generally on the anterior, more rarely on the lateral or posterior wall of the tumor. The abundance of large vessels, particularly veins, in the omentum, necessitates great care in hæmostasis. Every bleeding place must be protected by fine silk or catgut sutures, which are cut off short. Thick bands are cut after having received a double ligature or they are cauterized through. If the omentum is adherent over a large surface of the tumor we should not delay the operation by slow separation of the adhesions and numerous ligatures, but grasp the adhesions in one or more ligatures *en masse*, cut through in front of the ligatures, and leave the adherent parts upon the tumor. Contused and hemorrhagic portions of the omentum to which, after slow separation, an excessive number of ligatures are applied, should not be replaced in the abdominal cavity but should be cut off, after the application of a few ligatures *en masse*. Even the entire omentum has been removed in this way without injury to the patient. All parts of the omentum, which have remained outside of the abdomen for a long time, must be thoroughly disinfected by washing with antiseptic fluids prior to their reposition. The provisional or permanent attachment of separated portions of the omentum to the abdominal wound has been entirely abandoned.

Not until the tumor is withdrawn do adhesions to the intestines (on its lateral, upper and posterior wall) become visible. Very recent adhesions may be separated by blunt instruments or traction, but cutting instruments must be employed more frequently than with other forms of adhesions. The instruments are constantly held close to the tumor, and it is much better to leave a piece of the cyst wall upon the intestine than to expose the latter to injury. But the epithelium of the wall of the cyst, which is capable of proliferation, must be scraped off or destroyed by cauterization. Olshausen makes an incision around the point of insertion of such firm intestinal adhesions and then separates the outer lamella of the cyst wall, which is left upon the intestine, from the inner lamella. These remnants of the tumor, which are left on the intestine, may also be rendered innocuous by ligatures (Martin).

Superficial rupture of the brittle, congested serous layer of the intestines can not be prevented in all cases despite every precaution, and these wounds bleed with extreme obstinacy.

If the rupture is very small we should endeavor to raise the parts around the bleeding spot with a pair of forceps, and to apply a ligature around it. Otherwise the raw surface, after being folded in, is stitched together with the finest needle and silk thread, so that serous membrane is in contact with serous membrane.

It is sometimes extremely difficult to recognize the boundaries of the intestines, when these are collapsed or have become anæmic and pale from stretching during their removal. On the other hand, folds of the broad ligament, the tubes, band-like adhesions, even a broad membranous pedicle, may be mistaken for intestine. Unpleasant mistakes may be avoided by proceeding slowly and systematically, by drawing out doubtful structures or by following them with the finger inserted into the abdominal cavity, until their insertion or connection with other organs has been recognized.

Penetrating wounds of the intestines must be closed with sutures. In very extensive and firm adhesions resection of the adherent intestine may be taken into consideration, particularly if the intestinal wall itself is degenerated.

An adherent vermiform process may be ligatured *en masse* and cut off (Martin).

The same principles hold good, in general, with regard to the separation of adhesions to the liver, gall bladder, diaphragm, stomach and spleen. The difficulty of access to these parts renders necessary a considerable prolongation of the abdominal incision in order to make the adhesions visible, and to avoid, particularly with regard to the gall bladder and spleen, the dangerous results of rupture of these organs.

As a rule, considerable difficulty is engendered by pelvic adhesions to the bladder, uterus, the floor of Douglas's *cul de sac,* iliac fossa, mesentery of the sigmoid flexure. As these adhesions are the oldest they are characterized by great firmness and vascularity, and are not infrequently very extensive. It is therefore rarely possible to separate them by the introduction of the hand, and this can be effected by moderate traction in exceptional cases alone. Stronger traction is apt to tear the tumor, bladder, rectum, ureters, or even the large pelvic veins. Hemorrhages are then produced which can only be checked by acupressure or suture of the wound surfaces which have been produced. On the other hand it is also difficult to separate these adhesions with cutting instruments, as they cannot be drawn sufficiently into the abdominal wound. Nussbaum succeeded in one case by passing the hand into the cyst, which had been laid open, and raising the wall into a fold at one point. This was first done in the region of the sacral promontory. By traction on this fold he gradually succeeded in pulling the inverted cyst away from its adhesions to the pelvis, fossæ ilei and the posterior abdominal wall. But operators have been repeatedly compelled, on account of very firm and extensive pelvic adhesions, to discontinue the operation, or at least to leave a considerable portion of the tumor in the pelvis. Many of these cases were probably confounded with intra-ligamentary development.

The hæmostatic methods used in the separation of adhesions have been described in great part in the previous paragraphs. Larger vessels are treated by isolated ligatures, prolonged compression with forceps (Péan, Koeberlé), acupressure, ligature *en masse.* Capillary surface hemorrhages from the abdominal walls often cease spontaneously after the latter are retracted, or prolonged compression with a sponge or soft cotton cloth may be sufficient. If this proves unsuccessful, the actual cautery often produces very good results. It may be used without fear upon the abdominal walls, uterus and omentum. Indeed we have even applied the Pacquelin cautery (with feeble heat) to the intestines and bladder, allowing it to act merely by radiation. We have never been able to make up our mind to apply dilute liquor ferri or oil of turpentine (Martin).

More marked surface hemorrhages from the parietal peritoneum may be checked by acupressure or by passing the needles from the outside through the entire thickness of the abdominal walls around the bleeding spot, the ligatures being tied upon the abdominal walls over a piece of rubber tube. Martin surrounds such bleeding surfaces with a thread on four sides, so that when the thread is tied, the enclosed tissue projects like a button towards the peritoneal cavity. If obstinately bleeding surfaces are situated near the abdominal wound, they may be brought into close contact, in stitching the abdominal wound, by enclosing a large part of the peritoneum, and thus excluding the bleeding surface from the peritoneal cavity.

In very extensive and vascular adhesions the complete checking of capillary hemorrhage may be impossible, and we are then reduced to the alternative of a firm compress or drainage.

Hemorrhages from the wall of the tumor require special measures, such as the application of forceps, acupressure, ligature *en masse*, only when they are very profuse, and we are unable to reach the vessels of the pedicle with sufficient rapidity.

The removal of the tumor is impeded very much by brittleness of its walls, such as is observed in very thin-walled and particularly in inflamed cystomata. The wall of the sac ruptures wherever grasped, and the escaping contents flow over the field of operation. On further withdrawal some shreds of the cyst wall are apt to remain behind and escape our notice. If hemorrhage takes place at the same time from the torn wall or the surfaces of adhesion, we soon lose sight of the boundaries of the tumor and the proper performance of the operation seems impossible. But even in such an event, much can be done by a quiet, methodical procedure. Strong traction should be avoided. The adhesions should be separated exclusively by blunt instruments, the abdominal walls being everted; every part that is torn off is removed at once with blunt forceps, the outflowing contents are rapidly removed with large sponges, and no further steps are taken until the bleeding vessels are secured. But if we recognize, at the beginning of the operation, the impossibility of removing the adherent tumor without numerous ruptures of its wall, and still more if the contents are infectious, it may be better to stitch the sac to the abdominal wound than to complete the extirpation of the tumor. Not alone the sac wall, but the entire mass of a solid tumor may be so brittle, that it tears in two when withdrawn through the abdominal wound. This occurs particularly in malignant tumors, in benign tumors only after torsion of the pedicle. The consequent hemorrhage can only be checked by ligature of the pedicle.

As soon as the tumor, which has been diminished in size and separated from its adhesions, passes out of the abdominal cavity under the traction of the forceps, it is held without traction above the wound or is placed on one side, until the pedicle has been treated. At the same time the abdominal walls, immediately behind the tumor, must be pushed into a fold in order to prevent protrusion of the intestines. The assistant may also effect the same object by placing both middle fingers within the wound, while the thumb and index fingers press its edges together.

TREATMENT OF THE PEDICLE OR THE PELVIC CONNECTION OF THE TUMOR.

Formerly there were two principal methods of treatment of the pedicle:

1. The extra-peritoneal method; the ligated pedicle was drawn out and fastened in the abdominal wound.

2. The intra-peritoneal method; the abdominal wound is entirely closed and the pedicle remains in the abdominal cavity.

The latter method possesses so many advantages, that at present it is regarded as the only justifiable one. The former will be mentioned merely on account of its historical interest. Until recently we were entirely ignorant as to what becomes of the ligated portion of the pedicle and its raw surface and the ligatures, and in what manner they act upon the peritoneum. These questions have been answered by the experiments of Masslowsky, Spiegelberg and Waldeyer on animals. Their results have since been verified on numerous occasions by clinical experience and *post-mortem* examinations.

If the silk sutures are entirely aseptic, they are rapidly encapsulated in new-formed connective tissue, by the union of lateral ridges. The cut surface of the pedicle is only free for a short time, but soon becomes adherent to adjacent viscera or the pelvic peritoneum. As a rule, necrosis of the ligated part does not ensue because the vascular connections, which form between the lateral ridges, and between the cut surface and adjacent organs, (perhaps, also, imbibition from the surrounding peritoneal serum,) suffice to secure the minimum of vitality. After a time, however, the ligated portion shrivels on account of the insufficient nutrition, and may be completely absorbed. This is no longer astonishing in view of our knowledge of the absorption of large foreign bodies in the abdominal cavity of animals.[1]

In autopsies made one or more years after ovariotomy, either nothing was found of the pedicle and ligatures, or the latter were found in knots, as large as a millet seed, and covered with smooth peritoneum.

The material of the ligatures is encapsulated or finally disappears entirely. The absorption of catgut in the abdominal cavity has been directly demonstrated. Linen and silk threads last longer, but, according to the experiments of R. Wagner, Burdach and Middeldorpf, "these are gradually loosened by the entrance of young cells into their knots, finally they are defibrillated and the fibres entirely separated." It is very probable that in this way, through the agency of the white blood globules, silk and linen sutures are also entirely absorbed. But there are also other possibilities as regards the disappearance of the ligatures.

The terminations are entirely different when the ligated portion is infected during the operation, or the ligature material was not entirely aseptic. The results depend upon the quantity and quality of the infectious germs. If the ligated portion was infected with septic matters, a diffuse peritonitis rapidly develops; this also happens, when it becomes gangrenous on account of the action of decomposition-producers. If the ligated portion or the ligature material come in contact with suppuration-producers (in small amount), a circumscribed peritonitis will develop, and the entire process will be encapsulated by adhesions. The ligature and ligated portion are situated within a closed pus cavity, which ruptures in various directions, and may discharge not alone the ligatures, but also the ligated portion of the pedicle and even large shreds of the broad ligament. The formation of an abscess around the ligated portion of the pedicle sometimes does not take place until after the lapse of years.

In its present state of perfection the ligature is entirely reliable in every form of pedicle. The danger of internal hemorrhage from premature slipping of the ligatures is almost entirely eliminated by the perfected technique. Internal incarceration of the intestine can hardly be attributable to this method. Tetanus was observed much less frequently than after extra-peritoneal treatment of the pedicle.

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[1] Hegar observed the absorption of pieces of muscle, Czerny the absorption of even fresh pieces of cancer in the abdominal cavity of dogs within a few weeks. Ziegler demonstrated this with regard to small pieces of bone, Tillmanns with regard to pieces of liver, spleen, kidneys, and lungs.

Circumscribed suppurations around the ligated portion have become quite rare since the production of aseptic ligature material, and the thorough disinfection of the pedicle. This removes the only disadvantage, which formerly was erroneously attributed to the method itself.

Keith and others have obtained exceedingly favorable results from cauterization of the pedicle. The main part of the eschar produced by cautery is rapidly absorbed. Thus, in a patient who died of tetanus eight days after the operation, Kaltenbach found, at the site of cautery, a smooth, firm parietal adhesion and a few particles of animal charcoal; no trace of peritonitis. Heppner found a few particles of charcoal near the pedicle after the lapse of two years.

The immunity of the peritoneum against the cautery eschar is greater than against the ligated pedicle; circumscribed suppuration hardly ever occurs around the cauterized pedicle. It is characteristic of the action of the cauterization, that this was the first of all intra-peritoneal methods to furnish good results, even before the introduction of antisepsis. This is simply owing to the fact that the cautery itself acts antiseptically, inasmuch as it destroys all infectious germs upon and in the ligated portion. At the same time the strong compression within the cautery clamp, presses all decomposable fluids out of the pedicle. When sepsis sets in despite the use of the cautery, the pedicle and its raw surface were undoubtedly not the points of entry of the virus.

The only objection to the exclusive use of the cautery clamp is the insufficient protection, in some cases, against hemorrhage, especially when violent vomiting or coughing sets in after the operation. Even Keith limited, for a time, the application of this method, after he had been informed of a fatal after-hemorrhage in the practice of a colleague. Best adapted for cauterization are the broad, solid pedicles which contain numerous, but fine vessels, and at the same time are long enough to permit the application of Baker-Brown's cautery clamp. The safeguard against hemorrhage consists not alone of the action of the cautery upon the surface of division of the pedicle, but in the prolonged intense compression and heating of that portion of the pedicle which is grasped between the broad surfaces of the instrument, and by means of which it is "amalgamated" into a horn-like mass.

We possess very little personal experience concerning the exclusive use of the cautery clamp, but we do not regard it as positively secure against hemorrhage when applied to narrow pedicles which, apart from vessels of considerable calibre, contain very little other tissue. The ligature is often combined with cauterization, the ligatured pedicle being grasped in the cautery clamp and burnt off with the Pacquelin. We have obtained very good results from this method, but it may be dispensed with, as it prolongs the duration of the operation, and complicates the instrumentarium.

Other intra-peritoneal methods of treatment of the pedicle are recommended simply on account of the dread of leaving in the abdomen a portion of the ligated pedicle, and the ligature material. These include:

1. Removal of the pedicle with the écraseur.
2. Removal with the galvano-caustic cutting loop.
3. Twisting off the pedicle.
4. Isolated ligature of the vessels of the pedicle in the divided surface and their isolated acupressure prior to removal of the tumor.
5. Acupressure of the pedicle; a long needle is passed through the abdominal walls and pedicle, and the latter is pressed against the abdominal walls by means of sutures.
6. Masslowsky's sero-plastic method; a serous flap cut out of the pedicle is drawn over its stump, and, after cauterization or isolated ligature of the vessels, is stitched with sutures.
7. Torsion of the vessels of the pedicle. Successful results have been obtained in individual cases with all these methods. But they are in great part uncertain in checking hemorrhage, and possess merely an historical interest.

Among the extra-peritoneal methods of treatment, we mention the following:

1. Suture of the pedicle into the abdominal wound. After the application of a provisional ligament, a lance-tipped needle, several inches long, was pushed through the pedicle and abdominal walls, and fastened with sutures in circles and figures of 8. Langenbeck and Storer did not leave the surface of the pedicle free, but closed the abdominal wound

over it (pocketing the pedicle). This was done to prevent necrosis of the stump.

2. Clamp treatment (*vide* below.)

3. Graily Hewitt's method. The pedicle is tied in several divisions, and the sutures fastened on pegs, upon a steel frame 2½″ long, 1½″ wide, lying transversely across the lower edge of the wound.

A sort of middle course between the intra-peritoneal and extra-peritoneal methods was adopted by MacDowell, Clay and others. They tied the pedicle with silk or whipcord, cut one end of the ligature short, and passed the other through the abdominal wound (so-called long ligature). The lower angle of the wound was left open for ½ to ¾″, to permit the escape of secretion, and the discharge of the ligated portions of tissue and the sutures. Warren Greene modified this method by passing the ligatures through Douglas's sac into the vagina. The ligatures often did not come away for weeks and months, and maintained constant suppuration. Moreover the open portion of the wound formed a dangerous port of entrance for infectious germs. In 1865 Amelung devised "filopressure," a method which permitted the removal of the ligatures at the end of a few days.[1] Boecker recommended for this method the use of Braun's instrument, for temporary ligation of the arteries.

The extra-peritoneal treatment of the pedicle by sutures or the clamp, was the first technically complete method which gave the operator a feeling of security against dangers, which were partly real, partly imaginary. The protection against hemorrhage from the pedicle was nearly complete, and neither foreign bodies (ligatures) nor the stump of the pedicle remained in contact with the peritoneum. These advantages were very important, so long as antisepsis was unknown. Not alone hemorrhages, but all surgical maladies of the pedicle were thus converted into external processes, which ran their course under the observation of the physician.

But the clamp can only be applied conveniently to long, thin pedicles, which can be fixed in the abdominal wound without great traction.

Furthermore, the part which is constricted by the clamp undergoes necrosis, and this generally extends for a considerable distance in a central direction, towards the pelvic cavity. The necrotic stump may infect the abdominal walls, the thrombi in the vessels of the pedicle, even the abdominal cavity itself, unless an adhesion rapidly develops between the surface of the pedicle and the parietal peritoneum.

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[1] A peculiar device of this kind was described by Peaslee. The pedicle is ligated together with a silver perforated canula, within which the ligatures are cut with a knife at the end of three or four days.

It is true that this danger may be removed in very great measure by dry antiseptic dressings. But there is no doubt that it is safer to remove the pedicle entirely from the subsequent action of infectious germs by sinking it in the abdominal cavity.

Another disadvantage of the extra-peritoneal plan consists in the fact that, in the lower angle of the wound, the entire thickness of the abdominal wall does not heal by first intention. In this part the closure is produced, at first, by adhesion of the surface of the pedicle to the parietal peritoneum, and the funnel which is left over closes very slowly by the formation of granulations upon the edges. At all events, a thin broad cicatrix is left in the lower angle of the wound, and favors the occurrence of abdominal hernia.

Internal incarceration and tetanus have been observed much more frequently after extra-peritoneal treatment of the pedicle.

Very notable symptoms of traction of the pedicle, which had healed in the abdominal wound, have also been observed in some cases. On account of such symptoms, Baum and Baumgaertner were compelled to make a second laparotomy in order to free the pedicle from its connections with the abdominal walls, bladder and rectum.

Slight importance attaches to the occurrence of catamenial hemorrhages through pedicle fistulæ in the cicatrix (transverse section of the tube). This annoyance generally ceases spontaneously at the end of a few months. Mention is made of this symptom merely because it was formerly adduced as an argument against intra-peritoneal treatment of the pedicle.

Appendix: The experiments of Spiegelberg and Waldeyer on dogs may be divided into two classes. In the first, portions of the horns of the uterus were excised, and the ligatures were left in the abdominal cavity. In the second, portions of the uterus were removed with the galvano-cautery. As the result of the first series of experiments, it was found that the ligatures within the peritoneal cavity gave rise to no severe peritonitic symptoms, and could hardly be regarded as foreign bodies. They produced no notable necrosis. The first event, after the application of a ligature, appears to be the adhesion of the ridges of the ring which is constricted by the ligature (*vide* Fig. 118), and the threads are thus soon separated entirely from communication with surrounding parts. At the end of four weeks the ligatures are imbedded in fully developed connective tissue, and form small smooth nodules on the outer surface of the mesometrium. In other cases the ligatures had slipped off and lay free in the abdominal cavity, or they had cut through and floated in a small cyst in the ligated portion. The cut surface of the uterus does not long remain free, inasmuch as vascular adhesions soon connect it with the posterior wall of the bladder, loops of intestines or the mesometrium, and later are often converted into long bands. The ligated portion never shows a trace of mortification. In one case it had shrivelled to the size of a pea. Larger portions were enclosed in folds of the mesometrium.

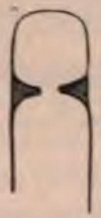

FIG. 118.

In the second series — excision of portions of the uterus with the galvano-cautery—three dogs were experimented upon, and were killed in six, fourteen and twenty-two days. On the sixth day the cauterized surface of the central uterine portion had a fresh appearance, and was studded with numerous small blackish particles of animal charcoal; the uterine tissue had a red color, to the depth of 2 to 3 mm., as if from imbibition of the coloring matter of the blood. The changes on the cauterized surfaces of the uterine horns were much more extensive. The mucous membrane and muscular tissue of the cornua were softened and necrotic to a depth of 2 cm., and all the vessels in this region were thrombosed. But the entire process was encapsulated in folds of the mesometrium.

At the end of 14 days all the cauterized surfaces were entirely encapsulated in folds of the mesometrium. The central uterine end was firmly adherent to the posterior wall of the bladder. The cauterized surface of the cornua was partly adherent to loops of intestine, partly retracted into the folds of the mesometrium, and, on microscopic sections, appeared as a fine line containing small brownish dots (animal charcoal.)

At the end of 22 days minute traces of animal charcoal were found; the cauterized surfaces of the cornua were covered with folds of mesometrium; the adhesions between the cauterized surface of the uterus and the bladder were elongated into bands.

TECHNIQUE OF THE ORDINARY METHODS OF TREATMENT OF THE PEDICLE.

1. We employ braided silk (Fig. 119) as the material for ligatures, inasmuch as the objections to this material have been removed since it can be reliably disinfected. It possesses the great advantage over catgut, that it can be tied much more tightly and securely, and does not tear so readily. Wire sutures offer no advantages, and their free ends may injure the walls of adjacent viscera.

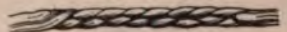

FIG. 119.—BRAIDED LIGATURE THREAD, ENLARGED SEVERAL TIMES.

The application of the ligature requires very careful technique, in order to prevent slipping. It should never be wound simply around the pedicle. The latter, grasped between two fingers, is perforated, at a place which is free from vessels, by well-rounded needles or Dechamp's instrument, a double thread is carried through, and each half of the pedicle is tied separately, without crossing the threads. It is necessary to use blunt instruments in applying the ligatures in order to prevent injury to the vessels of the pedicle. In tying the first knot, the threads should be secured in a reef-knot, and gradually drawn tight, until a deep and permanent furrow is produced; then a second and even a third knot are rapidly made.[1] Below the partial ligatures is applied another one which surrounds the entire pedicle. This offers still further security, and prevents oozing of blood from the point of entrance of the partial ligatures.

After the ligature is applied the tumor is removed with the knife or scissors, at a suitable distance from the sutures. It is necessary that at least 1 to 1.5 cm. of the pedicle should be left in order to prevent slipping of the ligatures.

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[1] Doran arrives at the singular conclusion that drawing the knot tightly gives rise to inflammation. According to him, a clot of blood at the end of the pedicle is the best possible condition; it indicates that the ligature is sufficiently firm to prevent serious hemorrhage without interfering with the nutrition of the pedicle. We regard this as a dangerous error and believe that it played a part in Doran's fatal cases.

Then the blood, which still remains in the ligated portion, is squeezed out with the fingers, the sutures are cut off short, the pedicle, particularly the groove made by the suture, is thoroughly disinfected, and finally the pedicle is dropped back.

Special conditions may necessitate various modifications in this method. Very broad pedicles must be ligated in 3, 4 or even more subdivisions; otherwise the ligatures can not be drawn tightly enough, or they cut through the lateral edge of the pedicle towards the uterus or the infundibulo-pelvic ligament. This does not always give rise to open fissures, but sometimes to extensive hematomata between the folds of the broad ligament, if brittle walls of vessels within the uninjured peritoneum have been cut through or slip back out of the ligatures. In a case of this kind Kaltenbach was compelled to pass elastic partial ligatures through the broad ligament, at a considerable distance from the first point of perforation of the pedicle. When the pedicle is very broad and short, the ligature *en masse* is applied behind the partial ligatures after the removal of the tumor; the pedicle then retracts into a much narrower space, and the ligature may be applied much more securely without cutting.

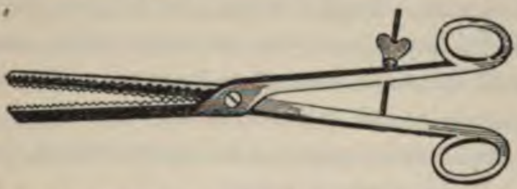

FIG. 120.—CLAMP FOR PROVISIONAL COMPRESSION OF THE PEDICLE. (After *Spencer Wells.*)

If a large tumor obstructs a free view of the pedicle, the latter is grasped provisionally in an elastic ligature, or a specially constructed clamp. (Fig. 120.) The tumor is then removed, and the permanent ligatures applied below the clamp.

Great caution is required in the treatment of twisted pedicles, inasmuch as they are often extremely soft and brittle. Whenever possible, the ligature should be applied to healthy resisting tissues on the central aspect of the twisted portion. On the other hand, it has been found in some cases, that pedicles which were twisted a number of times did not bleed after having been torn accidentally.

Since 1881 Olshausen uses merely an elastic ligature *en masse.* We have used these only under specially difficult conditions in very large and vascular or in very short pedicles. But it seems probable that elastic ligatures will find a larger field of employment as soon as experience teaches that the ideally secure ligature is not purchased at the expense of frequent secondary abscesses around the ligated portion of the pedicle. In two of our cases, the elastic ligatures were passed through the rectum 6 weeks and 3 months respectively after the operation.

In employing the cautery the pedicle is grasped in Baker Brown's clamp, and slowly burned through along the steel groove, by passing to and fro several times with the hatchet-shaped iron shown in Fig. 115, *b.* Keith employs only a moderate heat, the hot iron being dipped in cold water, until it becomes black. Finally, Keith takes an iron (Fig. 115 *c*), dips it in water until it is brown, and irons the stump of the pedicle, until it is perfectly smooth, and burnt through as far as the surface of the clamp.

The clamp is now cooled by means of a sponge dipped in cold water, the pedicle is fixed below it with two Koeberlé's forceps, the clamp is unscrewed and its blades carefully opened.

The entire procedure takes at least 10 to 15, occasionally 20 minutes. The portion of the pedicle which has been compressed and heated by the clamp then forms a horn-like, almost transparent plate, from 2 to 3 mm. in thickness. The cut surface has a brownish color. Keith watches the pedicle some time longer, inasmuch as he keeps it in the lower angle of the wound, and usually does not replace it in the abdominal cavity, until the toilette is complete.

If the hemorrhage is not checked entirely after the application of the actual cautery, the pedicle must be carefully ligated below the part which was grasped by the clamp.

MODE OF OPERATION IN INTRA-LIGAMENTARY DEVELOPMENT OF THE TUMOR.

The recent improvements in operative technique usually enable us to perform extirpation in the large majority of intra-ligamentary ovarian tumors.

The difficulties depend essentially on the degree of intra-ligamentary development and the firmness of the connections between the tumor and surrounding parts.

If the folds of the broad ligament still come in contact with one another below the tumor, the infundibulo-pelvic ligament together with the spermatic vessels, is first divided, after the application of an elastic ligature. The tumor now becomes more freely movable, and after incision of the peritoneum can sometimes be separated from its connections with the pelvic cellular tissue, by simple traction, so that it finally presents only a pedicle-like connection with the lateral border of the uterus; this may be treated in the ordinary way with elastic ligatures. The shallow intervening fissure in the broad ligament is closed with sutures, which bring the anterior and posterior layers in contact with their serous surfaces.

This method, on account of its simplicity and certainty, is decidedly preferable to the application of numerous ligatures *en masse* at the base of the tumor, with or without the aid of the cautery clamp and Pacquelin.

If the ligaments are completely unfolded, an attempt must be made to enucleate the tumor. The spermatic vessels at the lateral border of the tumor are first ligatured and cut. Starting from this point the peritoneal covering of the tumor is then cut in a transverse direction towards the uterus, and an attempt made to enucleate the tumor with the fingers from surrounding parts. When no farther progress can be made from the front, the posterior layer of the broad ligament is also incised, and the enucleation is completed from the side and behind in such a way that the connection of the tumor with the uterus is left until the last, and several ligatures *en masse* applied. The hemorrhage from the parametral cellular tissue is checked by isolated ligature of the vessels, or firm pressure with a sponge. When we have to deal with extensive surface hemorrhages and open vessels, very good results are obtained with Péan's T-forceps or Thornton's similar but more powerful instrument.

The greatest difficulty has been experienced hitherto in the rational treatment of the large cavity opened in the pelvic cellular tissue, with its constant hemorrhages and its, in part, torn inner surface. It was found as difficult to produce complete hæmostasis as to render it aseptic. If it was left open, blood trickled subsequently into the abdominal cavity, decomposed under the influence of the germs which, in such protracted and complicated operations, could not be entirely excluded, and gave rise to septic peritonitis. Not much better results were obtained from simple closure of the cavity superiorly by ligatures *en masse*, or a continuous suture. The trickling blood then remained encapsulated, at first between the folds of the ligament, but it usually decomposed in a short time, and gave rise to sepsis. Furthermore, the protecting closure against the peritoneal cavity was usually broken through after a time.

In these cases the best results are promised by over-suture of the opened parametrium, if necessary, after resection of excessive masses of ligament, and drainage of the cavity through the vagina. This plan, which was first recommended by Martin, after the enucleation of intra-ligamenatry uterine tumors, we have also employed successfully. From the floor of the intra-ligamentary cavity, Martin pushes a strong volsella through the fornix vaginæ, which is rendered tense by the insertion of two fingers, the latter receiving the blow. In the forceps, which are pushed down to the introitus vaginæ, he places a rubber tube with transverse bars, and draws it up into the cellular tissue cavity, which is to be overstitched. In this way the entire parametral cavity is securely closed against the peritoneal cavity, and is converted into an external wound. The end of the drainage tube was fastened in salicylated cotton or iodoform gauze, and the previously disinfected vagina stuffed loosely with the gauze.

As a matter of course the method is not so typical and comparatively simple in all cases. In many cases only a single well-preserved fold of ligament is at our disposal for the overstitching, or perhaps only a few shreds of ligament. By drawing upon adjacent parts of the serous membrane, and utilizing small peritoneal flaps, the defect must be covered as well as possible, and, if necessary, even the uterus with its serous lining is to be sewed to the parametral wound surface. Very free exposure of the deep-seated field of operation is necessary in such complicated operations. The intestines must be removed from the pelvis, and kept in the abdominal cavity, by means of sponges or cloths. Only in extreme cases would we venture to place the intestines in warmed cloths in front of the abdominal walls. Increased accessibility is also secured by a deep lateral incision of the rectus, and even of the peritoneum at the level of the entrance to the pelvis.

In certain intra-ligamentary tumors, which chiefly distend the median portion of the ligament, and are firmly united to the lateral border of the uterus, the isolated enucleation of the tumor may be attended with the greatest difficulty, while comparatively simple conditions are produced if the uterus is removed at the same time. We are especially justified in performing this operation when the ovarian disease is bilateral.

The advances made in the operation just described depend chiefly on the isolated and secure treatment of the main points of entrance of the vessels, and in the exclusion of the parametral wound surface from the peritoneal cavity. They are well shown on comparison with the primitive and dangerous methods which were adopted a few years ago in such cases. Thus, in moderate grades of intra-ligamentary development, an artificial pedicle was made of the folded base of the cyst, and this was treated by the extra-peritoneal or intra-peritoneal method. When the layers of the ligament were deeply unfolded, the attempt was made to check the hemorrhage by the application of hæmostatic forceps, which was kept in position; often a whole bundle of the forceps was drawn out through the lower angle of the wound. In some cases the parametral wound surface was separated from the abdominal cavity, by drawing forward the folds of the ligament, and fastening them extra-peritoneal (*traitement par suppuration.*)

Despite all recent improvements, the enucleation of an intra-ligamentary ovarian tumor remains a much more difficult operation than removal of a pedunculated tumor. Injury of the pampiniform plexus may give rise to very considerable hemorrhages, which are checked with difficulty. The ureters, bladder and rectum may be torn. Extensive thromboses, with all their dangerous consequences, form in the exposed, contused parametral venous plexus, which is separated in great part from its natural channels of outflow. And despite all our progress in technique, cases remain in which the operation cannot be completed, because the connections of the tumor with surrounding parts are too firm and extensive, or are imperfectly defined, entirely apart from those cases of bilateral cystoma, in which papillary proliferations in the walls of the tumor have perforated externally, and proliferated into adjacent organs, uterus, bladder, etc. The case is most unfortunate when we are compelled to leave behind portions of a solid, easily broken tumor. In cystic tumors, on the other hand, we may confine ourselves to partial extirpation, and stitch the pelvic segment of the tumor into the lower angle of the wound.

Schroeder draws the emptied cystic sac in front of the abdominal walls, then makes an incision into a less vascular portion or excises a piece, and, starting from this part, stitches the sub-serous portion of the cyst into the abdominal wound. The sutures are first applied to vascular portions and then the sac incised above these. As the cyst wall, which is to be stitched in, is larger than the abdominal wound, it must be drawn into folds (Fig. 121.) Instead of making several small folds, as at *a*, Schroeder subsequently adopted the plan of stitching the tumor smoothly from both sides of the lower angle of the wound, and in the upper angle made a large fold *b*, from the remainder of the cyst wall; both surfaces of the fold were sewed together. A drainage tube was carried through the floor of the cyst into the posterior fornix of the vagina. Mueller adopts a similar plan, except that the drainage tube is not drawn through the vagina.

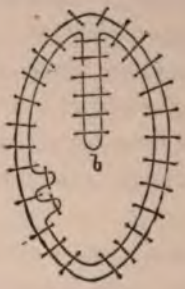

FIG. 121.

Recovery is said to result from purulent exfoliation of the cyst walls and the formation of granulations upon the shrivelled wall of the sac. In every case suppuration ensues with all its attendant dangers and lasts many weeks or even months.

The results of this method as regards mortality have not been bad, but there have been repeated relapses of cystic formations from remains of the sac walls which were capable of proliferation. The operation, therefore, does not secure radical relief, and is regarded by its originator as a *dernier ressort*, which is rendered less and less necessary by our improved technique.

EXAMINATION OF THE UTERUS AND THE OTHER OVARY.

After removal of the ovary and treatment of the pedicle we should ascertain the condition of the uterus and other ovary. Fibrous polypi on the outer surface of the uterus, if favorably pedunculated, are extirpated at once, either after application of a ligature, or, according to Schroeder's plan, by cutting them off close to their insertion and then closing the uterine wound with a few deep and superficial silk sutures.

But if a subserous myoma is extensively connected with the uterus, or if interstitial myomata are present, castration, *i. e.* the removal of the second ovary, is by far the most advisable procedure in the majority of cases. Extirpation of the uterine tumor or supra-vaginal amputation of the uterus need only be considered when the fibroma is large or when the uterine and ovarian tumors grow together intra-ligamentary and thus form a single whole.

The complication of ovarian tumors with pregnancy has been previously discussed.

The second ovary is easily felt by passing two fingers along the lateral border of the uterus and upper edge of the broad ligament. If it is degenerated it is extirpated in the same manner as the main tumor and its pedicle is treated intra-peritoneally.

If the pedunculation is favorable double ovariotomy is not more dangerous than single. But it is true that bi-lateral affections occur chiefly in tumors of unfavorable histological character and connections.

The second ovary is now extirpated not alone on account of decided cystomatous degeneration but also for other tissue anomalies, and whenever the patient, for any reason, will derive positive benefit from the cessation of ovulation. Special consideration is demanded, as a matter of course, by those cases in which children are eagerly desired by the patient.

As it is well known that conception may occur even when very little normal ovarian tissue is left, Schroeder has removed, in such cases, the degenerated portions alone, leaving the healthy portions of the ovary behind. Schatz reports a case of pregnancy occurring after an operation of this kind.

CLEANSING OF THE ABDOMINAL CAVITY.—DRAINAGE.

Before the abdominal wound is closed the abdominal cavity must be carefully cleansed of cystic contents, which have been extravasated into it, of ascitic fluid and blood, and, if possible, must be dried.

For this purpose we employ carefully disinfected and well-pressed sponges, more rarely linen compresses. We adopt the precaution of strictly separating the sponges used for cleansing the abdominal cavity from those which are applied to the wound or absorb the cystic contents, since the latter cannot be sufficiently cleaned of blood and cyst fluid during the operation.

They are placed in separate vessels and marked by white threads. These peritoneal sponges are dipped repeatedly into all possible receptacles of fluid, Douglas's sac, the vesico-ùterine fossa, and both lumbar regions, until they come out perfectly dry and clean. Peritoneal toilette can be shortened very materially by using larger sponges and exposing the parts as freely as possible. During the application of the abdominal sutures sponges are left in Douglas's *cul-de-sac,* and behind the abdominal wound, in order to absorb all fluid which is subsequently secreted and gravitates towards the pelvis, and the blood which trickles from the canals of suture.

The use of sponges demands caution in various directions. The intestines and omentum must not be violently pulled or pushed from their position during the introduction of the sponges, since this is apt to give rise to torsion or volvulus. In order to reach the floor of Douglas's sac the uterus is lifted up with two fingers and the sponge passed along its posterior surface, or the intestines are held back with the dorsum of the hand and the sponge carried along the palmar surface of the latter. Furthermore, the sponges used during the operation must be counted and placed under the sole care of a nurse. Otherwise, a sponge may remain unnoticed in the peritoneal cavity, and may not be discovered until the autopsy, or subsequent reopening of the abdominal cavity. This also holds good with regard to pieces of linen and instruments, particularly forceps. Spencer Wells succeeded in removing in one case a sponge, and, in a second case, a pair of forceps through the reopened abdominal wound on the day after the operation.[1] Sponges of small and moderate size, which are passed into Douglas's sac, should be secured in a sponge holder. Large ones are fastened to threads, which are carefully watched upon the abdomen by an assistant. The omission of this precaution once forced us into the predicament of being compelled for fifteen minutes to search the entire abdomen and pelvis for the missing sponge. It was finally found behind the sigmoid flexure, surrounded on all sides by its smooth mesentery. Fortunately the patient recovered without any complications.

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[1] Olshausen reports a case in which a pair of forceps, which were missed by the operator, were passed, per rectum, ten months later; abdominal pains had not been felt until two weeks previously.

The complete evacuation of extravasated fluids can be facilitated by compression of the abdomen, by pressure upon both lumbar regions and the epigastrium. Certain positions have also been employed for this purpose. Thus, after the necessary precautions against protrusion of the intestines, the patient has been placed temporarily in the abdominal or at least the latero-abdominal position. Nussbaum even performed the entire operation in the semi-abdominal position, in order to prevent the possibility of the passage of blood and cystic contents into the abdominal cavity. An elevated position of the chest which may be employed in either narcosis, also facilitates the gravitation of fluid towards the pelvic cavity.

Very great difficulty is experienced in the removal of tough gelatinous contents of tumors, especially if the sac has ruptured some time before the operation. The cyst contents are often so adherent to the parietal and visceral peritoneum that it cannot be removed with sponges. In such cases large quantities of disinfectant fluids or pure water have been poured into the abdomen, and the intestines thoroughly bathed therein. Then the fluid was discharged by turning the patient around, the intestines were placed in warm dry napkins and dried by moving them between the fingers. But there are serious objections to such irrigations despite the recent recommendation of Baumgaertner who employed warm solutions of salicylic acid (1:1000). They have been repeatedly followed by severe symptoms of shock and poisoning. Olshausen lost four patients from shock after using thymol (1:1000).

Large quantities of air not infrequently enter the abdominal cavity during the operation, if the abdominal walls are lifted up from the tumor during manual separation of adhesions, or if the cyst, which has been filled with air through the point of puncture, bursts. In such cases we attempt to remove the air by pressure on the lumbar regions and epigastrium. Its escape is attended not infrequently by a gurgling noise. Clinical experience and experiments show the great importance of thoroughly drying the peritoneal cavity. The best results have been obtained by operators whose methods were calculated to remove all decomposable material by careful peritoneal toilette and exact hæmostasis. Moreover, Wegener's experiments have shown that in hardly any other part of the body do animal fluids suffer such rapid decomposition after contact with atmospheric germs as in the abdominal cavity. On account of its enormous absorptive capacity rapid blood-poisoning occurs in a chemical and corpuscular sense.

But thorough drying and cleansing of the abdominal cavity are not always possible. The hemorrhage from exposed adhesion-surfaces or from opened spaces in the cellular tissue can not always be entirely checked; the intestines and parietal peritoneum cannot be entirely freed of the tough, sticky cyst contents. The further continuation of the toilette appears useless, and further patency of the abdominal wound may appear dangerous for various reasons. The conditions of pressure and absorption have been so changed by the operation that the continued oozing of bloody transudation during the next few hours may be almost certainly expected.

May we close the abdominal cavity in such cases, and expect rapid absorption of the accumulated fluid before the occurrence of decomposition?

The answer to this question is difficult and varied according to the standpoint attained in antisepsis. The conditions which favor absorption or decomposition are known in their general relations, but their mutual reactions are incalculable.

According to our present means of knowledge the occurrence of sepsis appears to be dependent on:

1. The number and importance of the infectious germs which have entered during the operation;
2. The quantity and quality of the remaining fluid;
3. The absorptive capacity of the peritoneum.

Our present antiseptic precautions offer sufficient security against infection with germs which are directly pathogenic, but we can never entirely exclude the decomposition-producers and suppuration-producers which are present everywhere in the air. But if the usual precautions are adopted for cleansing the air of the operating room, and for thorough disinfection of the vicinity of the field of operation, they will enter in such small numbers that they produce no bad effects or are rendered innocuous by the disinfectants upon our sponges. In difficult operations, on the other hand, and in excessively protracted peritoneal toilette, much larger numbers of germs are introduced, especially as the sources of error in antisepsis increase under such circumstances.

In addition to the germs which enter during the operation we must also take into consideration, in some cases, those which have been present in the interior of the cysts.

Finally, it is also possible that infectious germs or chemically toxic substances may enter the abdominal cavity from the intestinal canal, especially if the intestines are paralyzed or deprived of their endothelial lining.

The least dangerous fluid is pure blood, unmixed with other secretion. A mixture of blood and transudation from the wound, or blood and cyst contents, on the other hand, is extremely susceptible to decomposition. If the latter contained infectious germs, as the result of perforation prior to the operation, these find more favorable conditions for development after the entrance of air and mixture with blood and peritoneal transudation than in the closed cyst.

The amount of the decomposable substances also appears to be very important. Small quantities may be absorbed before decomposition takes place. Animals even tolerate the injection of small quantities of decomposed fluids, while large amounts prove fatal.

The more intact the capacity of the peritoneum for absorption, the more likely is absorption to ensue before decomposition has set in. The absorptive capacity of the peritoneum appears to be dependent on the amount of intra-abdominal pressure and intestinal peristalsis. Great diminution of the pressure after removal of a large abdominal tumor, and paralysis of the cooled intestines which have been exposed for a long time to the outer air, diminish absorption, while the same factors increase transudation from the peritoneum.

By limiting the cooling of the intestines as much as possible, and by applying an external compressing bandage, we may combat, in great part, the unfavorable effects of these factors. Finally, great influence is exerted by the histological structure of the peritoneum and the condition of general nutrition. In feeble, anæmic individuals we can hardly hope for undisturbed equilibrium between the processes of absorption and exudation. Recent inflammatory irritation of the peritoneum appears to diminish its capacity for absorption less than old, chronic, inflammatory processes which have given rise to callous thickenings or extensive, firm adhesions. The peritoneum presents very unfavorable conditions when it is intimately united to tough, gelatinous tumor contents, after previous rupture of a cyst.

As a general thing prophylactic drainage is not much employed at the present time. Reliance is placed on the greater efficiency of our disinfectants and the absorptive capacity of the peritoneum. Greater importance is attached to the exclusion of decomposition-producers than on the removal of material which may possibly decompose. Some former advocates entirely discard drainage, others limit its use to very exceptional cases. These include incomplete hæmostasis in prolonged operations in which torn and contused tissue is left behind, very unclean operations, with escape of infectious cyst contents and beginning peritonitis, injuries to the bladder and uterus (on acoount of the possibility of extravasation of urine.) The increasing limitation of drainage is founded, apart from the perfection of our primary antisepsis and of the technique of operation, upon the knowledge that the present methods of drainage are not very efficient and are associated with certain disadvantages.

865(?) In 1885 Peaslee first introduced prophylactic drainage. He passed an elastic catheter through Douglas's sac into the vagina, and through it washed out the abdominal cavity; ascitic fluid escaped through the catheter. In 1867 Kœberle employed glass tubes which were placed in the abdominal wound in cases in which the accumulation of large amounts of fluid was dreaded. In 1872 Sims recommended drainage in all, even the simplest, cases of ovariotomy. Sims receded somewhat from this first position, but to him undoubtedly belongs the credit of giving a great impetus to the renewed study of the causes and prophylaxis of septicæmia.

METHODS AND TECHNIQUE OF PERITONEAL DRAINAGE.

The abdominal cavity may be kept open through the abdominal wound, the vagina, or both parts simultaneouesly.

Drainage through the abdominal walls. For this purpose we use fenestrated, curved glass canulæ, 16 to 18 cm. long and with a lumen of 10 to 12 mm. (Fig. 122). These are pushed behind the uterus to the floor of Doulgas's *cul-de-sac*, and occasionally into the vesico-uterine fossa or towards the lumbar region, and are fixed in the wound by close apposi-

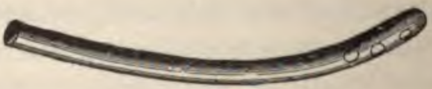

FIG. 122.

tion of the surrounding sutures. Keith placed disinfected sponges in front of the opening of the glass tubes and fastened them with india rubber cloth. At first the sponges are changed every 4 to 5 hours, later they are changed less frequently.

Hegar secures much more perfect antiseptic occlusion by covering the free end of the tube, which passes through an opening in the antiseptic abdominal bandage, with carbolized cotton and then with protective silk. The accumulated secretion is removed by means of a wire wrapped in absorbent carbolized cotton, which is kept permanently on the floor of the glass tube. From time to time—at first every hour, later, at longer intervals—the wire is removed, the glass tube cleaned by the repeated insertion of wire rods armed with cotton, until they come out perfectly dry. The dressing is then applied as before. By keeping the outer end of the glass tube projecting in front of the abdominal bandage, free access to the peritoneal cavity, associated with perfected cleanliness, is attained at all times without inconvenience to the patient. In addition to the force of gravity the increased intra-abdominal pressure (owing to the firm abdominal bandage) forces the secreted fluid in the direction of least resistance, *i. e.* the fenestra of the drainage tube. In addition the cotton acts by capillary attraction. The tube is removed in 2 to 4 days, according to the amount of secretion.

Hegar has recently employed much wider rubber drainage tubes, so-called abdominal specula. The tubes are 18 cm. long, their lumen 3 to 4 cm. wide. They are open below, and the lower portion also contains several series of openings, 1 mm. in width. The lower extremity is inserted in the part in which the collection of secretion may be expected, usually in Douglas's *cul-de-sac*, but sometimes in the lumbar regions, etc. Hegar stuffs the tubes with a large amount of absorbent, disinfected material, which possesses capillary attraction, and he even pushes it out of the tubes in various directions between the viscera.

In addition to drainage these tubes also facilitate the toilette, and occasionally may be used as specula for examining the abdominal cavity.

Drainage through the vagina exclusively has been rarely employed. Sims used canulæ, which consisted of two elastic halves, that were merely intended to maintain the patency of the wound in the fornix vaginæ. Others employed a rubber tube with transverse branches.

Sims's recommendation of simultaneous drainage through the abdominal walls and vagina by means of long rubber tubes has been very extensively followed. The opening of the pelvic cavity at its lowest point (Douglas's sac) led to the expectation of the constant free discharge of secretion, and, at the same time, this method afforded the possibility of antiseptic irrigation of the pelvic cavity.

Olshausen devised a trocar of large calibre, whose canula is 25 cm. long and lumen over 1 cm. in width, for perforation of the vault of the vagina. The wound produced by such a large trocar occasionally gives rise to very considerable hemorrhage. Injury to large vessels may be avoided by using small trocars and subsequent blunt dilatation of the opening, or the simple use of a stout volsella.

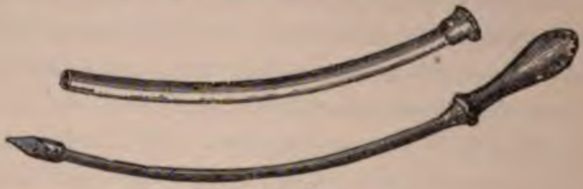

FIG. 123.

The drainage tube must have firm walls and wide calibre, in order that it may not be rendered impermeable by compression or occlusion. The tubes employed were about 60 to 70 cm. long and 1 cm. in diameter. A piece 15 to 20 cm. long lay in front of the abdominal wound, the intraperitoneal segment measured 10 to 15 cm. in length, and contained 6 to 8 openings with a diameter of 3 to 4 mm. The remainder of the tube lay in and in front of the vagina, and could be made of any length desired by the insertion of a glass tube. The abdominal end was passed through the lower or upper angle of the wound, while the vaginal end dipped into a vessel, filled with antiseptic fluid and placed beneath the bed, or was simply wrapped in a wad of carbolized cotton. In order to avoid wetting, the patient lay upon a funnel bed or upon an unyielding mattress, the tube being passed under her legs.

In order to prevent stagnation and decomposition of the secreted fluids, the majority of operators made antiseptic injections through the tube forthwith (diluted chloride water or salicylic acid 1:300). When the tube was thoroughly permeable Olshausen used 1 to 2 per cent. solutions of carbolic acid. The warmed disinfectant fluid was poured into the drainage tube by means of a glass funnel, and this was continued until the fluid ran out clear. At first the injections were made very often, for example, every half hour, but later, much less frequently. In order to make the injections very effective, several vaginal drains, and occasionally, also, a glass tube, were passed into Douglas's *cul-de-sac.* The rubber tubes were retained 3 to 8 days, according to the peculiarities of the individual case; longest in those in which solid portions of the tumor and therefore large foci of decomposition had been left behind.

The object of prophylactic drainage, *viz.* to remove the fluid accumulated in the peritoneal cavity before the occurrence of decomposition, is rarely accomplished. This result is impeded to a very marked extent by the irregular shape and histological character of the abdominal walls. The accumulated fluid may gravitate into various grooves and fossæ, and it is impossible to force it, by means of a strongly compressing bandage, towards the canals which are kept open by the drainage tubes. Tough cyst contents or clots of blood are more apt to be encapsulated between loops of intestines than to be forced towards the fenestræ of the tubes. Peritoneal fluids may also be moved in a direction opposite to that of gravitation under the influence of intestinal peristalsis and aspiration by the diaphragm.

Finally, each tube only drains the peritoneal cavity for a short time, inasmuch as it soon becomes encapsulated by adhesive peritonitis, and therefore can not remove fluid which is situated outside of the adherent loops of intestines.

The advantages to be derived from drainage are purchased, in each case, at the cost of new dangers and sources of error. The patency of the peritoneal cavity carries with it the danger of secondary infection, although this appears to be very slight if the proper precautions are adopted.

If a drainage tube remains *in situ* more than 36 hours, plugs of young connective tissue grow into the fenestræ and sometimes acquire an astonishing size in a very short time, especially under the fostering influence of stasis. The omentum or an appendix epiploicus may also be drawn into the interior of the tube by a large cotton plug, which acts like the piston of a syringe. If the tube is forcibly removed, these structures tear, internal hemorrhages ensue, and adjacent adhesions are ruptured. The development of a circumscribed peritoneal exudation or secondary sepsis often follows the removal or change of a drainage tube. If the tube is left in position for a long time it may give rise to necrosis of an adjacent portion of the intestine, or to compression-necrosis and secondary hemorrhage from the wound in the fornix vaginæ.[1] It has also happened that the drainage tube has slipped unnoticed into the peritoneal cavity (Nussbaum).

Vaginal drainage is the most dangerous, because infectious germs are especially apt to enter the abdominal cavity from the vagina, an organ which is kept aseptic with great difficulty. Inflammatory processes develop not infrequently, as the result of infection, in the pelvic cellular tissue near the opening in the fornix.

The apparent advantages of vaginal drainage, spontaneous evacuation of the fluid which gravitates to the floor of the pelvis, and the possibility of antiseptic irrigations, often prove illusory. There are often other sites of gravitation, such as the recto-uterine fossa and the lumbar regions, apart from the fact that the perforation through the fornix does not always correspond to the lowest part of Douglas's sac. Nor are intraperitoneal injections entirely free from danger. They may give rise to poisoning and to the further spread of previously encapsulated deleterious masses by the rupture of protecting adhesions and the stimulation of intestinal peristalsis.

Drainage through the abdominal wound would seem *a priori* to be less effective than vaginal drainage in producing complete evacuation of accumulated fluids, but this is disproven by experience. The intra-abdominal pressure, which is increased by the application of a bandage, is usually sufficient in itself to force the fluid into the glass tube, from which it is removed by capillary attraction in the manner indicated above. The chief advantage of drainage through the abdominal walls is owing to the fact that the glass tube is incompressible and can be kept aseptic with tolerable certainty. We have found this method relatively efficient in numerous cases, and therefore prefer it decidedly to all other methods in those rare cases in which we still resort to drainage.

CLOSURE OF THE ABDOMINAL WOUND.—THE DRESSING.

After the cleansing of the abdominal cavity, the wound is closed with sutures of silk, silver wire or catgut.

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[1] Three weeks after the removal of the tube Freund observed the exit of a living round worm from the drainage canal, which remained obstinately open.

Smoothing of the edges of the wound by cutting away projecting masses of fat or sugillated edges of the peritoneum is rarely necessary. We resort exclusively to ordinary suture with silk. At intervals of 1 to 1½ cm. deep sutures are introduced, passing through the entire thickness of the edges of the wound, including the peritoneum, fasciæ and muscular tissue. They are introduced and removed at about ½ cm. from the peritoneal edge and 1 cm. from the edge of the cutis. If a needle is threaded at each end of the suture both edges of the wound may be perforated from within outwards, thus affording to the beginner greater security against injury to the intestine and omentum. Before tying the peritoneal sutures, the sponges situated behind the abdominal walls and in Douglas's sac are removed, and their condition as regards cleanliness examined. Then the omentum is spread out behind the abdominal wound in order to avoid adhesion of the intestines to the wound, and, in case of suppuration in the wound or along the sutures, to facilitate encapsulation between the omentum and peritoneum. The sutures are then drawn tight and tied, after we have convinced ourselves that the intestines or omentum are not included. During the closure of the wound the abdominal walls, which have been raised into a fold, may be strongly compressed from both sides, and the blood, which has escaped between the edges of the wound, pressed out. Between the deep sutures are placed superficial and moderately deep ones in numbers sufficient to produce close coaptation of the edges of the cutis.

If a glass drainage tube is placed in the lower angle of the wound, the peritoneal edges of the wound must be closely applied to the tube by peritoneal sutures above and below.

The question of including the peritoneum in the abdominal sutures or not was long regarded as too important, since good results were obtained by both methods. Like the majority of operators we include the peritoneum, because it very soon adheres and thus protects the abdominal cavity from the subsequent entrance of blood or wound secretion. Experiments on animals also show that the omentum and intestines are especially to adhere to those parts of the abdominal wound which are not covered by peritoneum. Spencer Wells believes that a broad peritoneal cicatrix affords a good protection against later abdominal herniæ.

On the other hand it has been feared that the inclusion of the peritoneum in the sutures would give rise to the entrance of blood, pus or infectious matters through the stitch-openings, and that the occurrence of abdominal herniæ might be favored by the wedge-shaped tilting of the peritoneum between the sutures. If the abdominal walls are very fat we unite the peritoneal edges of the wound separately by a series of deep single sutures or by a continuous catgut suture, and then close the remainder of the wound by a second series of sutures which embrace all the other layers. Any cavities which remain between the two series of sutures must be drained. This method permits rapid closure of the peritoneal cavity and very complete disinfection of the abdominal wound, without permitting the subsequent entrance of blood or disinfectant fluids into the abdominal cavity. Tearing out of the stitches in the peritoneal edges of the wound is also prevented. Otherwise this is very apt to occur when the abdominal walls are very thick, if the sutures, which compass the entire abdominal wound, are drawn very tight. Under certain circumstances even several series of sutures may become necessary, and special care must then be devoted to the exact coaptation of the divided fasciæ and muscular sheath of the rectus, in order to avoid subsequent abdominal herniæ.

We will mention only a few of the innumerable modifications of the abdominal suture.

Since 1874, Kœberle stitches the tendinous membranes of the linea alba with a series of sutures, without including the peritoneum, subcutaneous tissue or muscles, and carries the long ends of the sutures out of the wound. Superficial strips of plaster are then applied and supported with collodion sutures.

If the peritoneum has been separated extensively it is fastened to the abdominal walls by mattrass sutures. This prevents the formation of large cavities, in which blood and secretion may stagnate.

After the extirpation of very large tumors, there is sometimes a considerable excess of the thinned abdominal walls which, on account of the diastasis of the recti, consist almost entirely of the cutis and peritoneum. As the functions of the abdominal walls must suffer if positive pressure within the abdominal cavity is not produced for a long time after the operation, Hegar and others have excised broad strips of the superfluous abdominal walls in such cases.

After the sutures are tied the patient is cleansed of blood, and, if necessary, provided with fresh clothing.

Upon the abdominal wound is placed a layer of salicylated or corrosive sublimate cotton and then a piece of protective silk. The entire abdomen is then rendered immovable by a snugly fitting cotton bandage. This simple dressing affords the abdominal wound sufficient protection during movements of vomiting and changes of position, and makes the support of the suture by means of strips of adhesive plaster, etc., entirely unnecessary. In the first few hours the compression may be quite marked, but it is diminished by loosening the bandage if the patient exhibits no tendency to vomit. More marked and protracted compression is only indicated when the trickling of blood or serum into the abdominal cavity is apprehended, or a negative pressure in the abdominal cavity must be converted into a positive pressure.

Immediately after the application of the dressing the catheter is passed into the bladder, the vagina is again disinfected, and the patient then put to bed. The trunk is placed as nearly horizontal as possible, the head slightly raised, the lower limbs also slightly raised. In this way the weight of the body is diffused very uniformly upon the support, and the annoying sliding down in the bed, which is so apt to produce bed-sores from unilateral pressure on the sacral region, is prevented. The middle of the bed is occupied by a large water pillow, above which are placed other pillows which should not be too yielding.

After-Treatment.

In the after-treatment we must particularly avoid excessive interference, as this has often proved injurious after ovariotomy. We should adopt the principle that nothing should be done from a medicinal or surgical point of view without a special indication. The majority of women complain of nausea and pain immediately after coming out of the narcosis. In others evidences of weakness or collapse are more prominent. With these three symptoms we are chiefly concerned during the first period after the operation. Conditions of weakness and collapse are counteracted by subcutaneous injections of ether or tincture of musk and by enemata of wine. If the bodily temperature has become subnormal it is raised by the application of heat by means of warming flasks. If the condition is due to anæmia, the head and trunk are kept low, the legs elevated.

Nausea and vomiting in the first few hours after the operation are the results of the narcosis. As the introduction of fluids into the stomach increases the vomiting, and internal remedies almost always prove ineffective, the patient should not ingest any fluids for 18 to 24 hours after the operation. At the most, small pieces of ice may be given if they do not give rise to cough. When the nausea and vomiting last more than 18 hours, hypodermic injections of morphine, particularly in combination with atropin gr. $\frac{1}{10}$, are often attended with astonishing results. But we are entirely powerless to relieve the vomiting produced by sepsis.

The pains are usually relieved very effectually by enemata containing 20 to 25 drops of laudanum. During the first few hours after the operation we make hypodermic injections of morphine only in those cases in which the patients have been accustomed to them.

The urine is rarely evacuated spontaneously in the first 24 hours. The patients must therefore be catheterized every 4 to 6 hours or as often as they feel pressure. The development of catarrh of the bladder can be prevented by careful disinfection of the catheter and the exposed meatus of the urethra.[1]

Distressing symptoms of flatulence usually set in on the second day, and, if they last a long time, are intensified into colicky attacks. As a rule the first flatulent discharges are not passed before the end of the second or third day, rarely not until a later period. From this time the majority of the patients date the beginning of a feeling of well-being, and to the physician likewise the symptom has a favorable prognostic significance, because it proves the permeability of the intestines. The introduction of an elastic or metallic tube into the rectum often shortens the stage of flatulence very materially. Internal remedies which stimulate peristalsis should be administered cautiously and not until a later period.

Great care must be devoted to securing a comfortable position and cleanliness, since in this way alone can bed-sores be prevented. If the patient has been placed in the position described above, a change will rarely be required before the end of the 3rd day. At the end of this time, however, the patient must be carefully raised from the bed and held horizontally by three persons standing on the same side of the bed, until the genitalia and nates have been cleansed of urine, blood, etc., and the bed freshly made.[1]

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[1] Since we employ solutions of corrosive sublimate for disinfection of the vagina and urethral meatus we have observed no cases of vesical catarrh, even after prolonged catheterization with simple metallic catheters.

A moderate uterine hemorrhage often appears on the 2d or 3rd day, even if the operation has been made soon after the cessation of menstruation. It is probably the result of collateral fluxion to the uterus after occlusion of the ovarian vessels. We regard this symptom, which occurs almost constantly in successful cases, as a favorable sign. In many patients it is followed by a subjective feeling of decided relief.

For the first three or four days the patient receives only fluid food, very little at a time but at short intervals. After the nausea has ceased we first administer to the patient a little tea or coffee, perhaps with the addition of a few drops of brandy. From the 3rd day we give meat broths with or without the addition of rice, barley or yolk of egg, tapioca soup, coffee *au lait*, milk, etc. After the 6th day, the patient may take zwieback with milk, chicken, etc. Flatulent food, such as vegetables and farinaceous articles, must be avoided for a long time in order to protect the abdominal cicatrix.

If the vomiting is obstinate and protracted, food and analeptics should be given per rectum. The violent thirst in such cases should be allayed by simple enemata of water.

The early occurrence of the first evacuation from the bowels may endanger, by the unavoidable action of the abdominal muscles, the union of the abdominal wound, or it may rupture protecting adhesions around the ligated pedicle and thus give rise to fever. Even the premature sliding off of the ligature is possible. If we give the above-mentioned food, which produces very little fæces, the patient, who was thoroughly purged before the operation, will rarely experience any desire to go to stool before the 8th day. About this time an evacuation should be secured by laxatives, such as calomel or castor oil in capsules, since prolonged constipation would produce the same disadvantages as too early abdominal pressure, on account of the hardness of the fæcal masses.

The careful observation of the temperature and pulse is absolutely necessary for prognosis and the timely recommendation of therapeutic measures. The temperature falls not infrequently below the normal, particularly after protracted operations (according to Werth, from 1 to

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[1] On account of the simplicity and certainty of this method we have never felt the need of more or less complicated lifting apparatus.

14 decigrades, 5.2 decigrades on the average). A completely ap course is not always attained, even under the strictest antisepsis, b maximum of the evening temperatures on the 2nd and 3rd days exceeds 38.5° in the vagina. A temperature above 39.5° during t three days is almost always produced by septic infection, and very tionally by circumscribed inflammatory processes around the ligated p in the abdominal wound or in remote organs, for example, the Considerable elevations of temperature, which do not begin until t

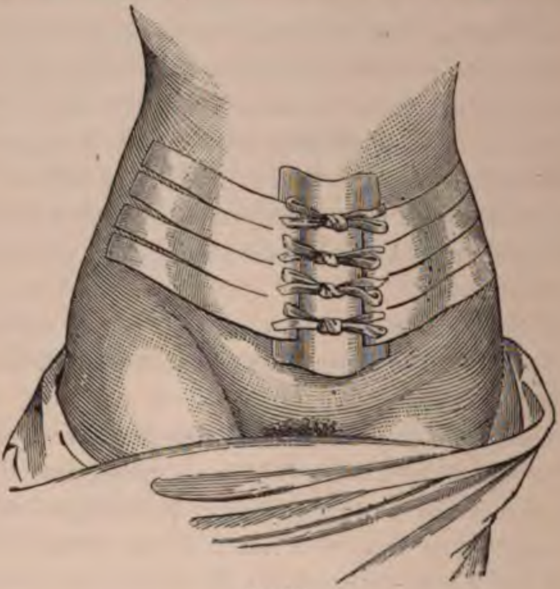

FIG. 124.

the 8th day, indicate suppuration in the abdominal walls, while ab around the ligated pedicle give rise to fever which begins later, is continued, but subsequently becomes strongly remittent.

The surgical after-treatment is very simple. The first dressing changed before the 7th day, unless blood trickles through or pain wound and fever indicate pathological processes in the abdominal w

The sutures are removed on the 8th day. On the day before, st adhesive plaster, which are split on both sides of the wound, and a over the wound by means of little bands which are sewed on, are a in order to protect the fresh cicatrix from lateral traction (Fig. Koeberle used the following dressing: three or four thick cords a twisted at one end and spread out like a duck's foot, and are made to adhere on both sides of the wound by means of collodion, while the intact median ends serve for tying.

As a rule, the secretion of the wound is reduced to a minimum, but it is only since the introduction of disinfection with corrosive sublimate that we have noticed the complete absence of every trace of suppuration between the edges of the wound and in the canals of suture. In badly treated wounds, œdematous or very fatty abdominal walls and insufficient disinfection, union by first intention is not secured over large surfaces and suppuration becomes profuse. Frequent change of dressing is then rendered necessary. The abscesses which develop in or near the wound in rare cases almost always start from insufficiently disinfected sutures and ligatures, and must be opened as soon as possible.

In a few cases the wound has been found to gape open to a greater or lesser extent either before or after the removal of the sutures. This unfortunate event may be due solely to mechanical causes, such as premature removal of the sutures, coughing or vomiting, prematurely getting out of bed. But, as a general thing, it results from infection of the edges of the wound, which have not healed by first intention, or from tympanitic distension of the abdomen in septic peritonitis. The intestines may protrude through the opening and even symptoms of incarceration may set in. The intestines must be replaced forthwith, perhaps after their size has been diminished by puncture, and fresh sutures introduced, supported by strips of adhesive plaster. But this plan promises success in those cases alone in which the healthy edges of the wound have separated as the result of mechanical causes, while in cases of infected wound or septic peritonitis the prognosis seems to be absolutely unfavorable not alone as regards the plastic results, but also as regards life.

ACCIDENTS DURING AND AFTER THE OPERATION.

Sudden death during or shortly after the operation is of rare occurrence. It may be the result of the narcosis, or of hemorrhage from torn or imperfectly ligated vessels of the omentum or pelvis.

Even apart from hemorrhage, death may be the result of cerebral anæmia if, after rapid removal of large tumors, a considerable portion of the blood in the body accumulates in the abdominal vessels, which have been suddenly relieved of pressure.

Some patients succumb to shock. Reflex paralysis of the heart results from the repeated injury to the peripheral terminations of the numerous nerves in the abdominal organs. The features become sunken, the pulse weak or intermittent, the respirations become superficial. The injuries to the nerve terminations need not be mechanical in character, as is shown by Olshausen's observations on the dangerous effects of injections of thymol into the abdominal cavity. In milder cases the symptoms of shock subside as soon as its cause is removed, for example, after the cessation of extensive manipulations of the intestines. In severe cases, however, the patients die during the operation or within 3 or 4 hours afterwards. Women who suffer from marked disease of the respiratory and circulatory organs are exposed to the greatest danger. Among Olshausen's five patients, who died of shock, one suffered from an old pleuritic exudation, another from sarcomatosis of the pleuræ. An anæmic fatty heart or brown atrophy of the heart is often found on autopsy in such cases.

The reflex depressive effects on the heart and lungs are combined with other severe injuries in complicated and severe operations, for example, great loss of blood, prolonged duration of narcosis and of the exposure of the peritoneal cavity. Wegener thinks that the latter factor proves dangerous on account of the notable loss of heat from the widely exposed peritoneum (parietal and visceral peritoneum and surface of the tumor), and the consequent diminution of the bodily temperature. As the result of experimentation Maass corroborates the great danger of prolonged exposure of the peritoneum, but thinks that it is owing, not to the direct loss of heat, but to the loss of water produced by rapid evaporation from the moist surfaces of the serous membrane, and resulting in considerable thickening of the blood, and thus in a notable diminution of the blood pressure and the production of heat.

The unfavorable influence of the last-mentioned factors is especially marked when the large size of the tumor and extensive adhesions necessitate a wide opening in the peritoneal cavity, or when the duration of the operation is prolonged to 2 hours or more. It is in such cases that the patients die within 24 to 36 hours, without having recovered even temporarily from the operation, after grave symptoms of collapse, subnormal temperature, sunken features, great prostration, small pulse (at first slow, later accelerated), superficial and irregular respiration.

Finally, the symptoms of shock may be combined with the most acute sepsis, and there is no doubt that some fatal cases, which were formerly regarded as shock, should be interpreted as sepsis, inasmuch as they were attended with considerable rise of temperature and even with anatomical changes in the peritoneal cavity.

Among the accidental injuries of other organs those of the intestines, bladder and ureters are the most important. These organs are most frequently torn or cut in loosening adhesions. The intestines may also be penetrated during the application of the abdominal sutures, or they are cut during the enlargement of the abdominal incision or even during the first incision. The treatment of injuries of the intestines and bladder depends upon the size and shape of the wound.

Incised and penetrating wounds of the intestines or bladder must be united with an inclosed suture, the edges being rendered smooth when necessary. The chief importance is to be attached to broad contact of the serous membrane.

Large, irregular openings require previous resection of a portion of the intestine, a procedure which is much preferable to the formation of an artificial anus by stitching the injured loop of intestine into the abdominal wound as was done in one case by Protheroe Smith. The intestine is compressed on both sides of the part to be removed by cushioned intestinal clamps, and simply sewed together with catgut or an elastic ligature. An intervening wedge-shaped piece and the corresponding portion of the mesentery are excised. The apex of the wedge is directed towards the mesentery, whose vessels have been previously ligated *en masse* or are ligatured in the cut surface. Among the various methods of intestinal suture we will describe only Czerny's double suture. Czerny enters the serous membrane with the needle 2 to 3 mm. from the edges of the wound and immediately in front of the mucous membrane, then in front of the mucous membrane of the other edge of the wound, and out through the serous membrane 2 to 3 mm. from the edges of the wound. In this way the edges of the wound and a strip of serous membrane 2 to 3 mm. broad are brought into coaptation. These sutures are introduced around the intestines at intervals of 3 to 4 mm. After they have been tied and cut short, a second row is inserted at intervals of $\frac{1}{2}$ cm. which, like Lembert's sutures, bring the serous layer into coaptation over a broader surface.

Great interest attaches to the four known cases of injury of the ureters which terminated favorably. This occurred in very complicated operations upon intra-ligamentary tumors or combined extirpation of the uterus and both ovaries (Walther Simon). The ureter was either cut through directly or was opened by ligation. The urine, which only communicated temporarily with the peritoneal cavity, was discharged subsequently through the lower angle of the wound by an abdominal ureter fistula. But the ureter, whose vesical extremity always obliterated, did not communicate directly with the cicatrix, but with a small urinary reservoir which was encapsulated between the abdominal walls and bladder.

In the first case—extirpation of the uterus and both ovaries by Walther of Offenbach—the urine was discharged from the left ureter alongside the extra-peritoneal pedicle. G. Simon cured the patient by extirpation of the left kidney.

In the second case Nussbaum had loosened a broadly adherent tumor after partial separation of the peritoneal layer of the uterus, and had grasped the pedicle in a wire écraseur. The écraseur was removed on the 11th day after the exercise of considerable force, and this was followed by the passage of a considerable amount of urine through the abdominal wound. Nessbaum made a new ureter by opening a way, by means of a trocar passed through the urethra, from the bladder to the urinary reservoir behind the abdominal wound. This canal was kept open permanently by the introduction of canulæ, so that the fistula healed towards the abdomen.

Hegar and Mueller operated in a similar manner.

Hegar first endeavored to heal the ureter, which had been cut through while removing an intra-ligamentary tumor, by stitching it into a wound in the bladder which had been produced artificially. The attempt was unsuccessful, but the urine passed partly through the abdominal wound, partly through the inserted vaginal drainage tube, without producing any bad effects. After removal of the drainage tube the opening in Douglas's *cul-de-sac* closed and the urine escaped solely through the abdominal fistula. An artificial ureter was then formed by perforation through the bladder. The abdominal fistula diminished very slowly in size. At the end of 9 months the canal was as fine as a hair, and permitted the passage of a minimum amount of urine.

In Mueller's case, the tumor was only partially extirpated, and the inferior intra-ligamentary segment of the tumor was stitched into the abdominal wound. Favorable course until the 10th day. Then an urinary fistula, which communicated with the ureter, formed deep down. The ureter was now connected with the bladder by making a communication between the funnel-shaped wound and the bladder, and then an attempt was made to cover the funnel by several plastic operations. In Sept., 1879, only a fine fistula remained.

Among the most unfortunate events in ovariotomy must be included those in which the operation cannot be completed. We disregard entirely those cases in which, from the start, only an exploratory incision was intended, because there was some doubt with regard to diagnosis or the practicability of the operation, and in which the abdominal cavity was closed immediately after the unfavorable condition of affairs was demonstrated.[1] We only regard an ovariotomy as incomplete when the extirpation of the tumor by puncture or separation of adhesions has been begun, and the impracticability or relatively too great danger of the operation is subsequently recognized.

If the operation is soon discontinued, the abdominal wound may be entirely closed after sewing up the opened cyst wall.[2] In many cases this is no longer possible, because the operation has gone too far and the tumor has been injured or destroyed. The opening in the sac wall must then be enlarged and stitched into the abdominal wound, as in partial extirpation of intra-ligamentary cystomata, in order to produce shrinking of the portion left behind by means of drainage or dry antiseptic dressings.[1] When abdominal portions of the tumor are left behind, the danger is much greater, because the secreting wound surface and the amount of necrotic tumor tissue are then much larger.

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[1] The field of exploratory incisions has been greatly restricted of late by the improved diagnosis of abdominal tumors and the advances in surgical technique. A number of tumors which were formerly left untouched (tumors of the uterus, spleen, and omentum, hydronephrosis, echinococcus sacs, etc.), are now extirpated or successfully treated in other ways after the performance of laparotomy. In ovarian tumors exploratory incision need only be considered with regard to the recognition of unfavorable connections or malignant character. In the former event we will merely, as a rule, resort to a modification of the operation (drainage, partial extirpation). In the latter event the exploratory incision is a serious operation which, in view of the other diagnostic means at our command, need rarely be resorted to.

[2] The only case in which Kaltenbach was compelled to discontinue an operation, after it had been begun, was that of an intra-ligamentary cystoma, to which a mass of intestines was extensively adherent. Despite the most careful attempts at separation the softened intestinal wall ruptured over a large area and necessitated closure with a number of sutures. In addition the histological character of the tumor appeared suspicious. The incision in the intra-ligamentary cyst wall (which was covered with peritoneum) was sewed up and the abdominal wound entirely closed. The operation was not followed by reaction. A few months later profuse intestinal hemorrhages. No further history was obtained.

The outlook is very gloomy if solid parts of a tumor have been removed and the torn remainder cannot be excluded from the peritoneal cavity by stitching it to the abdominal walls. We then possess no means of preventing the dangers which result from the communication of the degenerating tumor with the abdominal cavity.

Secondary hemorrhages almost always have their source in the vessels of the pedicle, in adhesion surfaces which have been laid bare, or in opened cellular tissue spaces. They rarely arise from the tearing asunder of the abdominal wound or from imperfectly ligated vessels. But Bayless reports a case in which the patient died of hemorrhage from an artery in the abdominal walls, 20 hours after the operation. Secondary hemorrhages generally occur within the first 24 hours. When the pedicle is treated intra-peritoneal late hemorrhages must be regarded as catamenial. The hemorrhage will be external or internal according to its source and to the method of treatment of the pedicle.

Intra-peritoneal hemorrhages vary greatly in significance. Slight amounts of blood are rapidly absorbed. More abundant hemorrhages may give rise to encapsulated hæmatomata, particularly in Douglas's sac. The relations of hemorrhage and sepsis have been discussed above. The hemorrhages resulting from slipping of the ligatures around the pedicle or omentum are the most serious and usually prove rapidly fatal. The present perfected technique will prevent this unfortunate accident with almost absolute certainty, while it was not infrequent in former times when the pedicle was ligated as a whole. Profuse hemorrhages are characterized by the symptoms of anæmia, when still more abundant by painful protrusion of both inguinal regions or marked depression of Douglas's sac. The only chance then resides in reopening the abdominal wound and r applying the ligatures. In some cases the diagnosis between internal hemorrhage and acute sepsis with free peritoneal transudation may be doubtful. But even in the latter event it is justifiable to open the abdominal cavity, although this procedure is rarely attended with success.

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[1] Perhaps dusting the sac with a mixture of tannin and salicylic acid (3 or 2 : would prove as effective as it does in the after treatment on an open extra-uterine fœtal sac.

After extra-peritoneal treatment of the pedicle the cause of the hemorrhage not infrequently consists in the fact that the pedicle has been cut by the clamp or wire sutures, or has been pulled upon during premature removal of the clamp. In other cases it was the result of erosion of the vessels in a pedicle which had not been kept aseptic. So long as the pedicle was united with sufficient firmness to the abdominal wound, the bleeding vessels could be grasped with artery forceps and tied, or the funnel in the lower angle of the wound could be tamponed with styptic cotton, etc. But if the pedicle had separated entirely or partly from the wound, it again became necessary to reopen the lower angle of the wound and to ligate the pedicle as a whole or in part.

After extra-peritoneal treatment of the pedicle small amounts of blood were occasionally found to trickle from the Fallopian tube, which had become adherent in the lower angle of the wound, at the time of menstruation. Based on this experience the possibility of similar processes after intra-peritoneal treatment of the pedicle was assumed. Very few authentic cases, however, have been reported in which catamenial hemorrhages occurred at a remote period after the operation.

Septic peritonitis is by far the most frequent cause of death after ovariotomy. It presents very notable differences in its anatomical and clinical course, according to the amount and quality of the infectious matters which have become effective. Whether the infectious substances meet with fluid material for decomposition in the abdominal cavity or not, also appears to exert a decided influence on the course of the disease.

Death may occur from septic poisoning before notable changes develop within the abdominal cavity. Or the autopsy reveals, at the most, beginning opacity of the peritoneum, some swelling of the retro-peritoneal cellular tissue, and a small amount of sero-bloody transudation. In the majority of cases, however, septic infection gives rise to a diffuse purulent or sero-fibrinous peritonitis.

In the clinical history of the disease the symptoms of septic poisoning or of the accompanying peritonitis may predominate, in other cases the sepsis acquires special characteristics from the complicating conditions of collapse. The febrile movement, accordingly, does not run a typical course. After the primary collapse has disappeared, there is usually a considerable rise of temperature (39 to 40°) in the first twenty-four hours. But this does not always maintain an ascending direction. It does not even remain constantly at such a height, but is not infrequently reduced to the normal by intercurrent remissions, and may thus be in striking contrast with the severity of the increasing general infection. Much more reliable data are furnished by the observation of the pulse which increases constantly and uninterruptedly in frequency after the operation, is usually 120 to 140 as early as the second day, and at the same time becomes small, easily compressible and irregular. The other prominent symptoms of the accompanying peritonitis are tenderness on pressure, meteorism and particularly vomiting.

Our treatment of fully developed primary sepsis is almost powerless. Even the heroic decision to make antiseptic washings of the reopened abdominal cavity, and by subsequent drainage to secure the escape of the decomposing transudation, has never, in our experience, been able to prevent the fatal termination in diffuse processes.[1]

We must confine ourselves almost entirely to symptomatic treatment. Koeberle[2] states that he has repeatedly relieved the vomiting and tympanites by the application of the stomach pump. We treat the meteorism by means of a moist fixation bandage and an ice bag. If the tympanites gives rise to severe dyspnœa, we may attempt to relieve the patient by puncturing the intestines with fine canulæ. The puncture of the distended intestines is directly indicated when they have separated the abdominal wound, and the closure of the latter cannot be effected in any other way.

The greatest benefit is derived from large doses of narcotics. They diminish the pain, relieve the restlessness of the patient, and are also the most effective remedy against vomiting. In some cases, indeed, the complete quiet secured for the intestines and abdominal walls may prevent the further spread of deleterious masses within the abdominal cavity, and thus convert the process into a local one. In favorable cases, the processes of exudation and absorption may be confined to a small, circumscribed portion of the peritoneum.[1] Deleterious fluids are especially apt to be encapsulated at an early period in the pelvic cavity. Even in such cases high fever, vomiting, dry tongue, and even obtunded sensorium are noticeable in the first few days. But the upper part of the abdomen remains soft and painless, and we are soon enabled to demonstrate an encapsulated, sero-bloody, purulent or ichorous exudation into Douglas's cavity.

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[1] This agrees with the experience of Schroeder, vide Deutsch. Med. Wschr., Mar. 8, 1879.

[2] Archiv. de Tocologie, Juillet, 1876.

If left to themselves the larger intra-peritoneal exudations usually prove fatal from sepsis or subsequent rupture into the free peritoneal cavity. It is rare that spontaneous perforation occurs early in a favorable direction, for example, through the lower angle of the wound. The artificial evacuation of the exudation through the vagina should therefore be performed, as soon as it is recognized with certainty. If the exudation extends to the abdominal walls or has perforated them spontaneously, the sac may, at the same time, be cleaned out from above. Spencer Wells, Keith, Freund and others, have obtained very good results from the opening of such encapsulated intra-peritoneal exudations.

A variety of circumscribed peritonitis, which is entirely distinct from that hitherto described, and which is chiefly characterized by its late occurrence and chronic course, develops when imperfectly disinfected ligature material acts as the carrier of infection, and the stump of the pedicle furnishes the sole material for decomposition. It is probable that, in such cases, suppuration-producers alone come into play, and the symptoms of primary sepsis are absent. There is no severe fever, or it does not set in until the end of the first week. In the second or third week we can demonstrate firm nodules of exudation in the vicinity of ligated portions of the omentum, loosened bands of adhesion or the ligated pedicle. After a remittent fever the encapsulated inflammatory products are often absorbed. In other cases an intra-peritoneal abscess develops and ruptures. This generally occurs in a favorable direction externally, or into adjacent hollow viscera (intestines, bladder, vagina), and very rarely into the free abdominal cavity. The most frequent sites of perforation are the rectum and abdominal wound. In addition to pus large shreds of ligated parts of the tissues, together with the ligatures are not infrequently discharged.

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[1] Kaltenbach observed a very instructive case of circumscribed peritonitis around the abdominal wound, which terminated fatally on the 9th day. Beneath the adherent wound the discolored peritoneal edges had separated. A loop of intestines was adherent to the vicinity of the wound by fibrinous exudation. The rest of the abdominal cavity and the ligated portions of both ovarian pedicles were entirely normal. The infection was unfortunately owing to the fact that the insufficiently disinfected assistant, to whom the anæsthetic was intrusted, had held the sutures of the abdominal wound for some time, while the sponges were being changed.

Extensive venous thrombosis sometimes occurs within the vessels of the pedicle or other ligated portions of tissues. This may be prolonged into the veins of the pelvis and thighs, or along the spermatic veins into the vena cava. The separation of large plugs is followed not infrequently by fatal embolism of the pulmonary artery. If the thrombi are infected or softened by an intra-peritoneal, purulent or ichorous focus, or by the gangrenous stump of the pedicle, unilateral or bilateral phlegmasia alba dolens or metastatic pyæmia will develop. In feeble anæmic individuals, marantic thromboses sometimes set in, particularly in the veins of the legs, and cause protracted convalescence, which is not free from danger, on account of the possibility of embolism and other complications.

Hypostatic pneumonia may develop under similar conditions, and, in connection with other varieties, for example, embolic and "foreign body" pneumonia, form a constant and not unimportant percentage of the causes of death after ovariotomy.

In a few cases death is the result of exhausting suppuration. Its sources consist of retained solid portions of the tumor, a large remnant of the sac which has been stitched into the abdominal wound, large intra-peritoneal abscesses which have perforated externally, and extensive bed-sores.

Intestinal occlusion plays an important part among the unfavorable events after ovariotomy. This may arise in various ways. It is sometimes the fault of the physician, who has included a loop of intestine in the sutures, or has drawn the intestine with the pedicle into the abdominal wound. Or torsion of free loops of intestines occurs. In Schinzinger's case, the torsion was produced by partial retraction and shortening of the mesentery. But other causes are much more frequent. A loop of intestine[1] is constricted laterally by the tense, extra-peritoneal pedicle, by a band of adhesion, which has been elongated, by an adherent portion of the omentum, etc., and is finally rendered impermeable, or it is flexed and thus rendered impermeable by recent adhesions to the pedicle, the abdominal walls, floor of the pelvis, the wall of an abscess or an abdominal organ (bladder, uterus). Fig. 125 illustrates a case of this kind, after Spencer Wells. A portion of the ileum immediately adjacent to the ileocæcal valve had coiled around the stump of the pedicle. The obstruction arose from the sharp flexion between the adherent and the free, very dilated portion of the small intestine.

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[1] Schroeder (Berl. Klin. Wschr. 1879, I.) saw the rectum incarcerated in front of the sacro-iliac articulation by the pedicle which was adherent in that locality.

The two last-mentioned phenomena are not infrequently associated. A portion of the intestine which is adherent in the pelvis is flexed, but at the same time other loops of intestines push their way behind the tense mesentery of the adherent portion of the intestine and are incarcerated. There are also transitions between and combinations of torsion of the axis and angular flexion of the intestine. The free portion of the intestine immediately adjacent to the adherent part is not simply bent at an angle but is also more or less twisted on its axis. The unravelling of the real condition of things may prove difficult even at the autopsy.

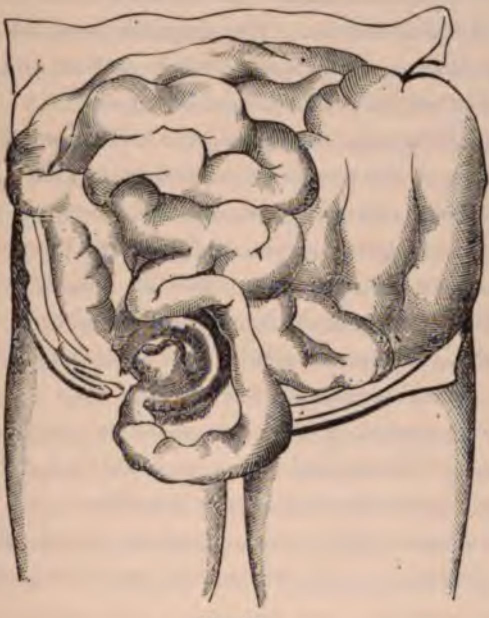

FIG. 125

Finally, openings in the omentum or mesentery which have been made artificially, may serve as openings for incarceration; this is also true of foramina which form beneath a Fallopian tube fixed in the inguinal canal (Kaltenbach). In accordance with its varying mode of development the intestional occlusion may appear in the first few days after the operation or not until after the lapse of weeks or months. Attention is generally called to this condition by the fact that the passage of flatus is delayed beyond the 4th day. Nausea and vomiting gradually set in, and there are no evacuations from the bowels. The diagnosis is difficult in those cases which are attended with fever and peritonitis, since the latter affection is almost always accompanied by signs which are attributable to impermeability of the intestines. The diagnosis is easiest when the signs of internal incarceration appear quite acutely and at first without fever, after convalescence has pursued a favorable course.

As soon as the diagnosis is assured, the abdominal wound must be reopened, the cause of the incarceration sought for, and, if possible, removed. The greatest chances of success are offered in simple torsion, incarceration by constricting bands, or flexions of the intestines by circumscribed adhesions. On the other hand the outlook is very bad when extensive adhesions have formed after peritonitis, since the separated surfaces again become adherent, as a rule, and the old condition is restored. The results of operative interference seem to have been very unsatisfactory. Hegar succeeded in only two cases in permanently relieving intestinal occlusion. In the first it was produced by a constricting band, in the second by a small adhesion of the intestine to the wall of a large intra-peritoneal abscess, which was opened at the same time. The first patient died of pyæmia 10 days, the second one 6 weeks after the operation.[1]

So much the more is it incumbent upon us to direct our attention to appropriate prophylaxis. Short pedicles or those which are adherent to the intestines may, under no conditions, be fastened outside of the peritoneum. The precautions necessary in peritoneal toilette and the application of the abdominal sutures have been previously discussed. The inclusion of the peritoneum in the sutures and the spreading out of the omentum behind the abdominal wound prevent adhesions of the intestines in this locality. The destruction or removal of the peritoneal endothelium by radiating heat, gross mechanical injury or the application of antiseptic fluids which are too concentrated must be avoided with the greatest care. The omentum must be carefully examined. Band-like adhesions to the abdominal walls or pelvic organs must be always separated, and window-like openings in the omentum must be relieved by removal of the part in question.

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[1] It may be mentioned as a curiosity that Jenks, in a case in which the patient presented signs of intestinal stenosis from the ninth day after the operation, placed her on her head on the twenty-first day, and that this was followed by the sudden escape of an enormous amount of gas from the anus.—*Amer. Journ. of Obst.*, July, 1878, p. 513.

In rare cases ovariotomy is followed by fæcal fistulæ. These may result from perforation above a stenosed portion of the intestine long after the operation, or from perforation of encapsulated exudations partly into the intestine, partly through the abdominal wound which has remained open. Finally, fæcal fistulæ may also result from injury to the intestine in the application of the abdominal sutures. In a case reported by Lyon the abdominal wound had closed incompletely; at its base was seen an adherent loop of intestine which contained several perforations as large as a pin's head, and through which fæces and gas were discharged externally. Various therapeutic measures were unsuccessful. Keith reports a case in which a pelvic exudation formed and ruptured, first through the abdominal walls and later into the rectum. After a time pus and fæces were discharged through the external opening, but finally the latter closed spontaneously. Bryant observed in one case that the ligatures of the pedicle (which had been tied with whip-cord and cut short) were discharged at the end of several months through an artificial anus at the lower end of the abdominal wound. In Spencer Wells's case the pedicle, with its ligatures cut short, was replaced in the abdomen, but a ligature, which had been carried around a firm adhesion in the left iliac fossa, was drawn out of the lower angle of the abdominal wound. At first only a small amount of pus escaped along this ligature, but later it was distinctly mixed with fæces. The patient died 20 months after the operation. At the autopsy a pus cavity, which communicated on the one side with the rectum, on the other with a loop of intestine, was found between the sigmoid flexure, rectum, and left border of the uterus. Similar observations have been since reported by Atlee, Olshausen and A. Doran.

It is only in exceptional cases that the perforation in the intestines is accessible, so that it can be closed by cauterization or suture. If the intestines were not alone perforated, but the lower part were at the same time impermeable on account of angular flexion, the attempt at direct union would have to be preceded by the operation for artificial anus or the resection of the perforated portion. If the intestinal fistula is situated very deeply, if it opens by a long sinuous canal only after communicating with an intra-abdominal abscess cavity, we should confine ourselves at first to thorough cleansing and to securing the free escape of the secretion of the wound, since it is in these very cases that spontaneous recovery of the fistula is sometimes observed (Keith, Atlee).

Tetanus is a comparatively frequent cause of death. To the 31 cases collected by us in 1881 with the aid of Olshausen's tables must be added 2 which were reported by Olshausen and Zweifel, and 1 by Malins. The large majority of the cases (27) occurred after extra-peritoneal treatment of the pedicle, and tetanus has become decidedly rarer since the extension of the intra-peritoneal method. The tetanus was formerly ascribed to the mechanical and traumatic influences sustained by the extra-peritoneal stumps in the clamp. It was supposed that incomplete or unequal compression produced permanent irritation of the nerves of the pedicle, and might lead gradually to the development of centrally progressing anatomical changes in the nerve tracts. This belief was strengthened by the fact that when tetanus occurred after intra-peritoneal treatment of the pedicle certain unusual traumatic influences had been brought to bear upon the pedicle, for example, it had been grasped temporarily by the clamp or encircled with the wire écraseur. But it cannot be denied that the pedicle, which has been fastened extra-peritoneal, is exposed to other (chiefly infectious) influences which start from the decomposing stump and which are escaped, as a rule, after intra-peritoneal treatment. The entire clinical history of tetanus corresponds most to an infectious or toxic process. This has become more and more probable since we have learned, through Maass, of the existence of certain tetanizing ptomaines which may, perhaps, develop in the decomposing stump, and, on the other hand, since the experiments of Nicolaier have shown that tetanus may be produced experimentally by inoculation with certain bacilli-containing earth tests.

The disease generally begins at the end of the first week and proves fatal within 2 or 3 days. But cases have been observed in which it did not begin until the 16th and 17th days and lasted 8 to 9 days. Only one case (Spencer Wells) terminated in recovery, after the endermatic use of curare (gr. $\frac{1}{12}$ and $\frac{1}{4}$ applied to the wound of blisters and to the pedicle). Opium, chloroform, chloral, curare, calabar, atropine, etc., proved entirely useless in all other cases.

Prognosis of Ovariotomy.

The prognosis of ovariotomy depends, above all, upon the thoroughness of our antiseptic measures. It is evident that these can be carried out much more easily and completely in hospitals, which are especially arranged for laparotomy, than in large hospitals which contain surgical and medical wards with their manifold pathogenic varieties of fungi. But even in such hospitals very good results may be obtained, if the instruments, assistants and nurses are kept separate, although this entails a disproportionately greater amount of labor and the employment of the most effective disinfectants.

The predominant importance of thorough disinfection of persons, instruments, etc., as compared with the danger of infection by atmospheric germs, is proven in a convincing manner by Schede's experience in the Hamburg General Hospital. Under disinfection with carbolic acid the results of laparotomy were absolutely unfavorable, but immediately after the introduction of disinfection with corrosive sublimate a continuous series of 25 recoveries was obtained. Similar observations were made in Giessen by Kaltenbach,—among 21 laparotomies with carbolic acid disinfection 2 deaths from sepsis, and 2 from suspicious conditions, *i. e.* in addition to internal incarceration, one case presented adhesive peritonitis, the other a circumscribed deposit of pus. After the introduction of corrosive sublimate disinfection, 24 peritoneal operations (Oct., 1884, to July, 1885), some of which were very complicated, ran a favorable course.

The prognosis also appears to depend on the histological structure and anatomical relations of the tumor, and the course of the operation dependent on these factors. We have previously referred to the dangers entailed by a malignant, brittle tumor wall, and by tumor contents which are infectious or very susceptible of decomposition.

The inability to diminish the size of the tumor, extensive adhesions, unfavorable connection of the tumor with the pelvic organs entail more serious traumatic influences: a larger incision, larger wound surface, greater loss of blood, injuries to adjacent parts. These factors also favor the occurrence of sepsis because complete checking of hemorrhage becomes difficult, and the prolongation of the operation also increases the period during which the abdominal cavity is exposed to the possible influence of the ubiquitous atmospheric germs. The more complicated the technique of the operation, the more numerous are the sources of error in the strict execution of our antiseptic measures. A larger number of hands take part in the manipulations; the sponges, hands, and vicinity of the field of operation are not as thoroughly clean at the end of such an operation as at the beginning. Finally a more intense degree of injury during the operation diminishes the power of resistance of the contused and torn tissues to external infectious germs, and the latter are, as it were, pressed *en masse* into the tissues. We have previously shown that a prolonged operation also acts unfavorably in other ways, by the increased cooling of the parts, and by the prolonged narcosis.

From the great significance of the anatomical relation of the tumor, and of the severity and duration of the operation trauma, the influence exerted upon the success of the operation by the skill of the operator and the selection of the cases, follows as a matter of course. But we here desire to emphasize the fact that we may go farther in the cautious selection of cases for operation than comports with the true interests of the patient, and that brilliant statistics sometimes depend chiefly on the exclusion of cases which are anatomically and technically complicated, and in which the indications for operative interference are often the most imperative.

Finally, the general condition of the patient as regards health and vigor exerts great influence on the results of the operation.

Complications, such as anæmia, diseases of the respiratory organs and kidneys, play a considerable part among the immediate and remote causes of death after ovariotomy. The patients either succumb directly to the results of such diseased conditions, or they die of shock, exhaustion, hypostatic pneumonia, thromboses and their sequelæ,[1] in causal connection with such diseases. Advanced age also exerts a bad influence on the results of operation by diminishing the power of resistance of the patient. To this factor must be added the often more unfavorable histological character of the tumor and the more extensive adhesions. The best results are obtained in otherwise healthy women between the ages of 20 and 40 years.

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[1] Thromboses of the veins of the pelvis and thighs are not infrequently present before the operation, and, therefore, a fatal pulmonary embolism may not be regarded *a priori* as the result of the operation. Like Schroeder and Dohrn we have observed fatal pulmonary embolism shortly before the day set for the operation.

SUBSEQUENT CONDITION OF THE PATIENTS AFTER OVARIOTOMY.

The subsequent condition of the patients after a successful ovariotomy is of interest from several points of view, and has been followed by various authors (Wells, Keith, Olshausen) in a very satisfactory manner.

Unilateral ovariotomy does not impair the sexual functions. The patients may menstruate regularly, conceive and bear children. They may give birth to children of both sexes, even to twins and triplets;[1] nor does sexual desire undergo any change.

The effect of bilateral ovariotomy is the same as that of castration. In such cases we can hardly speak of a diminution of the sexual and generative functions as the result of the operation, inasmuch as sterility has usually been produced by the bilateral disease, and even if the disease is very little advanced on one side the occurrence of conception is undesirable on account of the tumor of the other side.

The large majority of the patients remained perfectly healthy after the operation. Some died of acute or chronic intercurrent diseases of various kinds, which were in no wise connected with the previous affection.

In some patients the second ovary was attacked later by the same benign disease and a second operation was thus rendered necessary. Comparatively few new cases have been added to the fifteen collected by Olshausen, in which a second ovariotomy was performed upon the same patient. This may, perhaps, be attributed in part to greater care in the examination of the second ovary. The first operation of this kind was performed by Atlee in Philadelphia in 1861, 16 years after an operation by Clay.

In the second operation the abdominal incision is made parallel with and about 2 to 3 cm. distant from the previous cicatrix. This is not done so much on account of a suspicion of the firmness of the cicatrix but of possible adhesions of the omentum, intestines and pedicle along the previous incision. In a second operation Keith had to contend with a serious hemorrhage from the markedly dilated vessels of the old pedicle, which had undergone extra-peritoneal treatment.

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[1] One of Spencer Wells's patients gave birth, six years after the operation, to living male triplets.

In rare cases a relapse of benign cystoma appears to occur upon the side of the first operation. In one of Hegar's cases, in which a benign proliferating cystoma had been extirpated, a second intra-ligamentary tumor of exactly the same histological character, developed 2 years later upon the same side and proved fatal from compression of the pelvic organs.

A number of the patients have been attacked by cancer of the peritoneum and pelvic viscera after the lapse of months or years. Such cases, of which Olshausen has collected quite a number, must generally be regarded as local relapses, due to the retention of malignant tumor germs, which were not recognized during the operation. Circumscribed cancerous deposits in the walls of apparently benign cystomata are apt to be overlooked even after microscopic examination. Furthermore, diffuse peritoneal carcinosis may develop from small particles of tumors or cell heaps which enter the peritoneal cavity during the operation or even previously from rupture, and are then carried farther by peristalsis.

Similar metastases may also occur in more benign tumors, for example in myxoma of the ovary. Thus, two years after an ovariotomy, Olshausen found the abdomen filled with a gelatinous mass weighing 7 pounds, partly free, partly as an envelope over the intestines; it was traversed by thin membranes, which were lined with cylindrical epithelium.

An annoying disturbance of the subsequent condition is sometimes produced by abdominal hernia, which protrudes in the cicatrix, particularly in the lower angle of the wound.

This occurs much more frequently among the laboring classes than might be supposed from the scanty references to the subject in the literature. We have seen it develop even when the cicatrix was short and firm, although we dismiss no patient without a well-fitting abdominal bandage.

The hernia may terminate in complete eventration, if bodily exertion is continued or if pregnancy occurs. Kaltenbach observed the entire uterus, at the 7th month of pregnancy, lying in the hernial sac. The integument was so remarkably thin and tense, that it contained ischæmic tension ulcers. Reposition through the constricting opening in the recti was impossible, and spontaneous premature delivery occurred in the 28th week. In such cases the superfluous attenuated abdominal walls may be resected, after the sutures have been introduced. Simon and Hegar have attempted recently to relieve the hernia by operative means.

The following is Simon's plan: After pushing back the hernia towards the abdominal cavity the adjacent edges of the inverted abdominal walls are denuded over a strip 2 cm. in width and as deep down as the lower layers of the subcutaneous cellular tissue, and then stitched together. The denuded strips come in contact above and below (Fig. 126, *a*) at an acute angle. The internal posterior edges of the cutis are first united by superficial sutures, which are tied in the direction towards the abdominal cavity. The involuted sac of the cutis is closed in this way, and it is then merely necessary to unite the adjacent freshened surfaces by a series of deep and superficial sutures (Fig. 126, *b*). In order to convey the secretion of the wound and skin from the cavity situated behind the closed wound, a small drainage tube is inserted in the lower angle of the wound (Hadlich). In two cases treated in this manner Simon obtained perfectly satisfactory results, in one case after the first, in the other after the fourth operation.

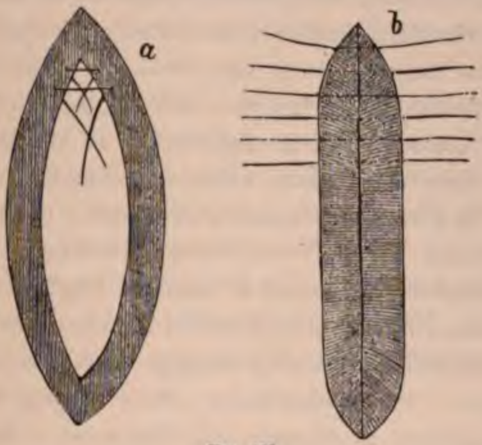

FIG. 126.

In 1879 Hegar adopted a similar plan. He gave to the denuded surface the shape of a horseshoe, which was open towards the umbilicus. But only a few bridging cicatricial bands were preserved, and the patient passed out of observation.

Ovariotomy through the Vagina.

The first systematic operation of this kind was made in 1870 by Gaillard Thomas, after he had performed it eight times upon the cadaver. A tumor of the size of a large apple lay movable in Douglas's *cul-de-sac*, and had given rise to pain and symptoms of compression. The fornix was seized with a hook, in the knee-elbow position, and, after the introduction of a valvular speculum, was cut, together with the peritoneum, with a pair of scissors. A bougie had been introduced into the rectum. The patient was then placed in dorsal decubitus, the small tumor, which was felt above the incision, was punctured, and drawn into the vagina.

The pedicle was then ligated in two halves, in lateral decubitus, and replaced and the vaginal wound was closed with silver sutures. The operation was finished in 35 minutes, and the patient recovered, after suffering from parametritis of the right side. In another case Thomas was unable to remove the ovary, which was slightly enlarged, through the vagina. The rectum was injured and it finally became necessary to perform laparotomy. The patient died on the 3rd day.

Gilmore successfully extirpated a tumor as large as an orange; the ligated pedicle was stitched into the wall of the vagina with three sutures. Davis even succeeded in removing through the vagina a tumor which weighed 9 pounds. The incision in the posterior vaginal wall was 4 inches long; it was necessary to separate, with the hand, a few anterior and posterior adhesions.

In Clifton Wing's case the diagnosis between hæmatocele and ovarian tumor was doubtful. The tumor, which had a broad insertion, was peeled out of the broad ligament and no ligature was applied. It was necessary to replace prolapsed loops of intestines. Sutures of the vaginal wound; drainage by the introduction of a catheter. Recovery.

Goodell successfully extirpated, after puncture with aspiration, a suppurating tumor which contained 4 litres. Baker extirpated a suppurating dermoid cyst; the patient died.

The greatest number of vaginal operations have been performed by Bailey, not for the removal of tumors, but for the purpose of castration.

Ovariotomy through the vagina possesses no future. The disadvantages of the method consist of the poor view that can be obtained of the field of operation, and of the great danger of injury to other parts (rectum, small intestines, etc.) Complete hæmostasis is impossible, if it has been necessary to separate adhesions or if vessels have been torn. Moreover, the peritoneal wound is especially apt to be infected through the vagina.

The operation can not be performed at all in the case of large tumors which project into the abdominal cavity, or small ones which possess broad and firm connections with the pelvic organs.

The method is only practicable with technical exactness when the tumors are small and freely movable in the pelvis, and such tumors can be extirpated at least as well through the abdomen. The only advantages of the method, the opening of the abdominal cavity at its lowest point and over a small area, and the intact condition of the abdominal walls (no hernia), do not furnish a sufficient equivalent for the other dangers in ordinary cases.

Vaginal ovariotomy is decidedly justified and indeed demanded by the topographical conditions in those rare cases in which the cystic ovary is situated within a vaginal prolapse in front of the external genitalia. Olshausen observed a posterior vaginal cystovariocele of this kind, but merely treated it by palliative puncture. The first (but previously unintended) vaginal ovariotomy in a case of this kind was performed in 1857 by Atlee. He successfully extirpated a cyst, which lay between the bladder and uterus, and had pressed both organs out of the pelvis.

PUNCTURE OF OVARIAN CYSTS.

Puncture of ovarian cysts is performed as a radical or palliative curative method, and also for diagnostic purposes.

In proliferating cystoma a radical cure by puncture can only be effected when the tumors have assumed the characteristics of simple retention cysts, after the destruction of their secreting epithelial lining.

At the present day it is generally employed as a mere palliative remedy in those cases in which the patients cannot make up their minds to permit ovariotomy or the physician considers the chances of the operation to be too unfavorable. Puncture often enables us to gain time. Thus, unilocular cysts or tumors with a predominant main cyst are punctured when the complication with pregnancy is present. This relieves the symptoms of the patient, prevents the danger of rupture, and enables us to delay ovariotomy until a more convenient time. Spencer Wells has collected numerous favorable cases of puncture during pregnancy, in some of which puncture was performed repeatedly.

It may also be advisable to precede extirpation of very large tumors by a preliminary puncture. The lungs, intestines and kidneys are thus relieved, dropsical swellings removed, and the general condition improved.

If the question is merely one of palliative relief we should not hurry the first puncture, inasmuch as the sac soon refills, and the strength of the patient is then rapidly exhausted by the enormous losses of albumen. Cases like that of Martineau, who prolonged the patient's life 25 years by means of 80 punctures, or that of Moreau, who punctured 28 times in 28 years, are very exceptional. It is best to delay palliative puncture until the tumor has produced marked symptoms of compression of the theracic and abdominal organs or its rapid growth threatens rupture. In exceptional cases puncture may be indicated when the cyst is comparatively small but is wedged in the pelvis and produces symptoms of incarceration, or violent, neuralgic complaints from pressure on adjacent organs, or when it obstructs the passage during delivery.

It has also been employed extensively for diagnostic purposes, for example, in the differential diagnosis of ovarian cysts and cystic formations in other organs (hydro-nephrosis, echinococcus sacs, fibro-cystic tumors of the uterus), or in distinguishing the individual forms of ovarian tumors or their complications (malignant tumors, hemorrhages into the cyst). Puncture was also employed formerly to obtain accurate information concerning adhesions and to distinguish simple impaction in the pelvis from broad connections of the tumor.

Diagnostic puncture has lost much of its former value since our other diagnostic aids have been improved so considerably, and since almost all those forms of disease, upon whose exclusion so much weight was formerly attached, are now treated by operation.

Puncture may be performed through the abdominal walls, vagina or rectum.

Instruments.—The simple trocars, composed of canula and stylet, which were formerly employed, have been almost entirely replaced by Thompson's instrument. This is more convenient in every respect and guards more securely against the entrance of air. The construction of this instrument is readily understood from the accompanying cut (Fig. 127). Upon turning the screw x the stylet may be entirely removed. At y is inserted, at a right angle, a metallic tube connected with a rubber tube. The stylet should be fitted so accurately that, when lubricated, it is air-tight in the canula. In order to be perfectly sure that air cannot enter by aspiration, the rubber tube is filled, from the tip of the canula, with water, and, when the stylet is pushed home, this cannot escape. If the instrument is then pushed into a cyst and the stylet is withdrawn, the escaping contents will meet the water in the dependent tube and will flow out like a siphon. As a further precaution the outer end of the tube may be kept under water or connected with a funnel apparatus, whose elevation to the level of the fluid is a sure preventive of the entrance of air. If the puncture is made for the purpose of evacuation the diameter of the canula should be 4 to 8 mm. according to the consistence of the fluid; if the abdominal walls are very thick or the cyst is deeply situated, care should be taken that the part of the canula which is situated in front of the rubber tube is sufficiently long. An exploratory trocar or Dieulafoy's apparatus is employed for diagnostic puncture.

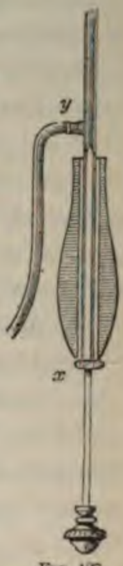

FIG. 127.

PUNCTURE THROUGH THE ABDOMINAL WALLS.

Position.—When Thompson's trocar is employed the patient assumes a comfortable dorsal decubitus. In using the earlier trocars, in which the evacuation of the cyst was not the result of a syphon action, but of the weight of the column of fluid above the tip of the trocar, of intra-abdominal pressure and partly of external compression, it was necessary to open the cyst at the most dependent portion. The patient was therefore seated upright, or midway between the sitting and recumbent positions, or she was placed at the edge of the bed and a little on one side.

Selection of the Site of Puncture.—Large unilocular cysts or predominant main cysts are best opened in the linea alba, and at a sufficient distance from the symphysis, because large vessels are less apt to be wounded in this locality. In multilocular and partly solid tumors, after careful determination of the boundaries by palpation and percussion, that spot is selected at which the largest cavity which is filled with fluid is closely applied to the anterior abdominal wall. Large visible cutaneous veins, and those regions in which arteries may be wounded, are avoided; valuable hints in this matter are afforded by auscultation. The inferior epigastric artery is avoided most certainly if the puncture is made in the middle of a line drawn between the umbilicus and the anterior superior spinous process of the ilium. In repetition of the puncture the previous site or its vicinity is selected.

Mode of performing Puncture.—Before puncture the bladder is emptied with the catheter. We must also convince ourselves by careful percussion and palpation that there are no loops of intestines situated in front of the cyst. The trocar is applied at right angles to the carefully disinfected site of puncture and is pushed in quickly. The stylet is withdrawn as soon as the cessation of resistance shows that the interior of a cyst has been reached. Quite a considerable amount of force is required to penetrate a thick abdominal wall. The tough cutis often sinks deep in before the stylet of the trocar before it suddenly yields, and in this way a thin walled tumor may be ruptured, even in a situation other than that directly perforated. Hence it is advisable, particularly when a large trocar is used, to make an incision into the cutis at the site of entrance.

During the evacuation of the fluid contents an assistant presses his hands lightly against the abdomen in order to prevent the canula from slipping out of the diminishing cyst and to avoid excessive diminution of the intra-abdominal pressure during coughing spells or deep inspirations. But when the syphon action of Thompson's trocar is brought into play it is unnecessary to aid the escape of the fluid by compression of the abdomen by means of crossed bandages, etc. If the escape of the contents ceases on account of its tough consistence, a syringe may be connected with the rubber tube and suction exerted. If the canula becomes plugged with clots, it may be made permeable by pushing in the stylet. If the first puncture effects insufficient diminution in the size of a multilocular cyst, it must be repeated in another place, or the stylet is pushed through the same opening in another direction and into an adjacent cystic cavity. The flow sometimes ceases because the trocar has penetrated too deeply, and the canula does not enter a cavity of fluid until it is partly withdrawn.

The rule obtains that the evacuation should not be performed too rapidly, in order that the pressure on the previously compressed abdominal vessels should not be removed too suddenly. The trocars formerly used were therefore provided with stop-cocks, in order to be able to interrupt the flow from time to time. In using Thompson's trocar, the stylet is merely pushed a little forwards, and the rubber tube is compressed, or its terminal portion, which is connected with a funnel, is raised.

In withdrawing the trocar the integument and cyst wall are grasped between the index finger and thumb, the canula being withdrawn between them with a slight rotatory movement.

The opening must be accurately closed in order to prevent the subsequent trickling of blood, cyst contents or ascitic fluid. For this purpose a stout needle is passed transversely below the bottom of the opening through the entire thickness of the abdominal wall, and is then surrounded with a few turns of thread. The needle must be inserted to such a depth, because the bleeding vessel may be situated immediately over the peritoneum. Spencer Wells reports a case of fatal hemorrhage from a varicose vein, which passed directly from the umbilicus to the liver (patent umbilical vein). Smaller openings, which have been produced by an exploring trocar, are covered with a small wad of antiseptic cotton or are dusted with iodoform.

Puncture through the Vagina was first performed in 1775 by Callisen. It is feasible in cystomata which are situated entirely or in great part in the pelvis and forcibly depress Douglas's *cul-de-sac*. In small cysts, which are impacted in the pelvis, vaginal puncture is the only practicable form. It is not well adapted for large multilocular tumors, whose larger cavities are directed mainly towards the abdominal cavity. Thompson's trocar must be somewhat modified for vaginal puncture, the anterior part of the canula being elongated, and the part which carries the rubber tube being given off at an acute instead of a right angle.

If the end of the tube, which is filled with water, is connected with a glass funnel, the evacuation of the fluid may be readily combined with medicated irrigation of the cyst. Nœggerath employs long aspirator needles in vaginal puncture. Curved instruments are not necessary. If the cyst is situated very high, the patient is placed in the breech-dorsal position, and straight instruments will then suffice. The perforation is made in the median line of the posterior fornix into the most tense portion of the cyst. In this way the ureters and large vessels are most surely avoided. An assistant, with both hands upon the abdominal walls, presses the cyst deep into the pelvis, by which means it is steadied and rendered more tense. The trocar is pushed in under the guidance of two fingers of the left hand. Exposure with a speculum is not advisable, as the tension of the vagina will interfere with our observation of the boundaries of the fluctuating tumor and thus increase the difficulty of determining the direction of the puncture.

Very complete evacuation may be effected by vaginal puncture. It is said that a radical cure has been repeatedly procured by this plan alone (Nœggerath) or in combination with other methods. On the other hand it may prove dangerous on account of injury to the rectum or bladder or the entrance of air, if the previously mentioned precautions are not carried out.

Puncture through the Rectum requires the same anatomical conditions as vaginal puncture. But it presents no advantages even when the cyst is adherent to the rectum, inasmuch as fæcal masses or gas are very apt to enter the cyst and to give rise to acute gangrene. Rectal puncture was regarded as advantageous, because the fluid escaping from the cyst is retained, like a watery stool, by the sphincters instead of trickling continuously as after vaginal puncture.

The patient should stay in bed for some days after the puncture. The abdomen is rendered immobile and compressed by a cotton batting dressing. If this precaution is neglected, the sudden diminution of pressure in the abdominal cavity may lead to hemorrhages into the cysts or to enormous abdominal plethora and secondarily to cerebral anæmia. Profuse syncope and even sudden death have been observed as the results of this condition. But this occurred almost always in those cases alone in which puncture had been performed in the sitting position, and the fluid was evacuated very rapidly through a wide trocar.

Very firm compression of the abdomen also prevents in a measure the rapid reaccumulation of fluid in the cysts. Baker Brown formerly desired to raise puncture with subsequent compression, and combined with the administration of diuretics and mercurials, to the dignity of a radical cure, and claims to have had 11 successful results by this plan. Under certain circumstances the uterus may assume the role of the subsequent compression. Spencer Wells reports a case in which he ruptured the cyst on the day before the patient's marriage; she became pregnant at once and the cyst did not refill.

Among unfortunate accidents after puncture we may mention the following, in addition to those previously described:

1. *Hemorrhages.*—Apart from larger vessels in the abdominal walls those situated in adherent portions of the omentum (Peaslee) or in the cyst wall itself may be injured. Fatal hemorrhages, from perforation of the inferior epigastric artery, have been reported by Richter, Brüninghausen, Ehrlich and others. If the injured vessels are situated in the abdominal walls or the cyst wall, they are usually compressed so long as the canula is *in situ*, and the hemorrhage occurs externally or internally after the withdrawal of the instrument. If brittle, vascular, papillary proliferations within the cyst are injured, the blood escapes at once with the evacuated fluid. Even as many as 5 or 6 pounds of blood have been found extravasated into the interior of the cyst or the peritoneal cavity. Acupressure is only effective in hemorrhages from the abdominal walls, when these can be completely elevated into a fold. If the bleeding point is situated more deeply, it is reached with difficulty by acupressure, and large vessels are apt to be again perforated in this way. As soon as the signs of internal hemorrhage become decided, an incision must be made, therefore, through the abdominal walls, search made for the bleeding vessels, and, if necessary, ovariotomy performed forthwith.

2. *Injuries of other Parts.*—The bladder and rectum are especially apt to be injured in vaginal puncture in consequence of a wrong direction of the perforation. The bladder, which has been drawn upwards, or a loop of intestine situated in front of the tumor, may also be perforated through the abdominal walls. Even the elevated uterus may be endangered. These accidents may almost always be avoided, at least in simple cystomata, by the previous introduction of the catheter and sound, and by careful palpation and percussion. On the other hand, we observed, in an autopsy, double perforation of the intestine which was surrounded on all sides by a malignant tumor. This patient did not succumb directly to the injury, but to inanition.

3. *Suppuration or gangrene* of the cyst may result from the use of unclean instruments, entrance of air, or insufficient disinfection of the site of perforation. This is followed either by an adhesive, encapsulating peritonitis or by a diffuse peritonitis, if infectious contents of the tumor enter the abdominal cavity in large amounts.

4. The escape of tumor contents from the point of perforation also involves danger in another direction, inasmuch as it may give rise to the implantation of tumor germs in the abdominal cavity, to the formation

of metastases. This occurs not alone in malignant tumors but also in papillary and myxomatous cystomata.

The immediate danger of puncture[1] has become very slight since the introduction of antiseptis and proper instruments, and the restriction of the operation to suitable cases of unilocular cysts or predominant main cysts. Nevertheless puncture should be restricted as much as possible, because it may interfere with the result of a subsequent ovariotomy. This is less the result of the production of adhesions, which often remain absent after numerous punctures, than of the introduction of infectious germs within the tumor, which often occurs despite every precaution, or the dissemination of tumor germs in the abdominal cavity.

The first puncture is generally regarded as much more dangerous than subsequent ones. This depends simply on the fact that the puncture of some tumors is a dangerous operation. The danger then appears at the first puncture and the operation is not repeated. This category includes cystomata with vascular, papillary proliferations on the inner surface, cystomata with purulent, hemorrhagic or very tough contents, and dermoid cysts. Cysts with clear serous contents, especially when they are adherent to the abdominal walls, may be punctured indefinitely without the production of bad results. For example, Ramsbotham punctured a patient 129 times in 8 years, Bamberger 253 times in the same period.

OTHER METHODS OF OPERATION IN OVARIAN CYSTS.

Since a radical cure is so rarely produced by simple puncture, the attempt was made to prevent reaccumulation of the fluid by keeping the cyst permanently open towards the outside, or by combining puncture with the injection of irritant fluids.

I. The term *drainage* may be applied to the former method. The sac is to be made to shrivel by means of suppuration. The cyst was kept open:

1. By incision and stitching of the sac into the wound.

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[1] The danger was formerly much greater, because unclean and improper instruments were used, and all ovarian tumors were punctured indiscriminately. But even then the danger was not as great as was claimed by those who were endeavoring to justify ovariotomy. For example, Hock had calculated, from a collection of 123 cases, that 17 per cent. died a few days or hours after puncture, and a further 19 per cent. before the end of the first six months.

2. By the permanent insertion of canulæ. The drainage may be made through the abdominal walls or vagina, or through both regions.

Drainage through the abdominal walls is only practicable in those cystomata whose larger segment is applied to the abdominal wall. The danger of the operation is in direct proportion to the size of the sac. The majority of the patients died in a few days from extensive gangrene, which could not be kept within bounds by antiseptic washings, or they died later from exhausting suppuration. The danger was especially great in those cases in which the entrance of decomposing tumor contents into the abdominal cavity was not prevented by the adhesions which were present or by the mode of operation. In the most favorable event recovery occurred after a sickness lasting months and years, with all the intercurrent dangers which may develop in incomplete ovariotomy and which have been previously mentioned. Almost all of those who recovered suffered for years from suppurating fistulæ and were by no means assured against relapses. For example, Thornton reported for the London Medical Society (Jan. 12th, 1879) three cases of ovariotomy which he had performed upon the patients 4, 3½ and 11 years after they had been regarded as cured by incision and drainage. All of the patients recovered, although strong adhesions were present.

Drainage through the abdominal walls as a primary method possesses merely an historical interest; we have previously stated that it may be used, in case of necessity, in incomplete ovariotomy.

Incision of the cyst through the abdominal wall was first employed by Le Dran in 1737, and a few successful cases have been reported until recent times, particularly in suppurating tumors, which were adherent on all sides.

The permanent introduction of canulæ has been used much more extensively. Successful results have been obtained in this way by Ollenroth, Pagenstecher and Desprès. Jobert has modified this plan, inasmuch as he kept the canula *in situ* only for a few hours after puncture, until the cyst contents had entirely escaped.

In order to avoid the entrance of decomposed tumor contents into the abdominal cavity, the attempt was made to produce adhesions by the application of caustics, or by pushing needles into the cysts, or to press the cyst against the abdominal walls by means of trocars which, after perforation, permitted the escape of spring blades.

For the sake of completeness we may also mention that the opening the cysts with chloride of zinc paste or the actual cautery has also bee recommended and carried out.

Vaginal drainage possesses a somewhat greater value.

In 1841 Schwabe first obtained a successful result from the introduction of canulæ though the vagina. Later Kiwisch and then Scanzoni became ardent advocates of vaginal drainage. Kiwisch first punctured, then enlarged the trocar wound with the knife, and then introduced, for several weeks, a tin tube through which several injections of lukewarm water were made daily.

Scanzoni allowed the silver tube of the trocar to remain *in situ* in order to prevent premature closure of the wound and to secure the free escape of the accumulated fluid. Among 23 cases treated in this way violent inflammation of the cyst wall occurred 6 times, but these very cases were among the successful ones. In 5 cases the fluid soon reaccumulated; 4 passed out of observation; in 14 cases radical recovery is said to have occurred, some of them being kept under observation for 20 years. Scanzoni employed this method in unilocular cysts alone.

Noeggerath has recently performed vaginal ovariocentesis successfully in cases of large cysts. He exposes the posterior fornix with Sims's speculum, and cuts directly through the vagina and peritoneum down to the cyst. Then the cyst is punctured, this opening is enlarged, and the cyst wall stitched to the vagina.

When proper cases were selected the results of vaginal drainage were much better than those of abdominal drainage. Vaginal drainage was employed especially in those cases in which the conditions were exceptionally favorable to this procedure, while the technical difficulties and dangers of ovariotomy appeared unusually great. For example, in small intra-ligamentary tumors or those which were firmly adherent to the floor of Douglas's sac, and in which interference became necessary on account of symptoms of compression of the pelvic organs or suppuration of the tumor. Incision of the tumor at its lowest part then assured complete evacuation, and, at the same time, the entrance of the cyst contents into the abdominal cavity was prevented by the existing adhesions. In a case in which the existence of adhesions could not be ascertained with certainty, Hegar produced adhesion of the sac by the application of chloride of zinc paste to the posterior fornix.

In addition to the small dimensions of the cyst a thin, retractile condition of its walls is also important as regards the success of the operation. In thick-walled cysts the suppuration was apt to become exhausting on account of its long duration, or the excessive growth of granulations upon the wall of the tumor gave rise to retention of secretion with all its consequences.

During the after-treatment the opened sac was washed out antiseptically and the free escape of secretion secured. For this purpose the vaginal wound, which exhibited a great tendency to premature narrowing, was occasionally dilated either with a blunt instrument or the knife. Large masses of granulations were also removed occasionally from the interior of the sac by means of a curette.

Small tumors which were firmly adherent to the pelvic organs and a segment of whose walls was, at the same time, firmly applied to the abdominal walls, were formerly drained above and below.

Recamier adopted this method as early as 1839, the abdominal walls being first punctured, and then the canula pushed towards the bottom of the cyst in the recto-uterine fossa, and the trocar, controlled through the vagina, again pushed through in this locality. Delore has recently recommended this procedure in combination with previous cauterization of the abdominal walls and vagina. Double drainage through the abdominal walls and vagina formerly possessed a certain amount of value in suppurating cysts, especially if rupture through the abdominal walls was impending or had occurred. It was repeatedly employed in the Freiburg clinic with relatively good results in suppurating dermoid cysts. But the healing process is so protracted[1] in all methods of drainage, and is threatened by so many complications, that we would hardly decide upon such a plan at the present time, especially as relapses due to the further growth of small cystic cavities inside of the wall of the tumor are by no means excluded.

II. *Iodine injections* were recommended by Velpeau in 1843, after such good results had been obtained by the corresponding treatment of hydrocele. They were first tested, on an extensive scale, by Boinet.

Among his first 100 cases, 62 are claimed to have been cured, in 38 the injection was unsuccessful (16 fatal cases). In 1856 Velpeau made a report on 110 cases treated by injection of iodine, of which 64 were cured, 36 were not made worse, and 10 died. In 20 other fatal cases the canula had been retained and the cases were therefore not included among those of simple injection of iodine. Simpson claims to have cured a third of his 40 to 50 cases, Schuh cured 4 cases out of 10. On the other hand West obtained only one permanent recovery among 8 cases; in 2 patients relapses occurred at the end of 1½ and 2 years. Among 8 operations made by Simon and Orth only one terminated in recovery, one patient died soon after the operation, five died subsequently from marasmus. Veit obtained 3 permanent recoveries, among 16 cases; two patients died, one of peritonitis, the other of iodine poisoning.

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[1] Desprès mentions cases in which fistulæ persisted for five and seven years, and the sacs were filled by masses of granulation as large as a child's head.

The results claimed by Boinet, Velpeau, Simpson and Schuh are entirely illusory. The majority of the patients were operated upon in hospitals and they were subsequently lost from observation. They were reported as cured if they did not die soon after the operation, or if at their dismissal no signs of reaccumulation of fluid were present. The experience of those physicians who, favored by local conditions, were able to ascertain the subsequent condition of their patients, shows that sooner or later relapses almost always develop.

When contrasted with the scanty successes the danger of iodine injections is very considerable. The iodine often produces a violent inflammation of the cyst. On account of the slipping of the canula from the cyst wall and subsequent trickling from the site of puncture the injected fluid may enter the abdominal cavity and give rise to diffuse peritonitis. Erosion of the cyst wall by the iodine solution and subsequent rupture have also been observed. In addition there is the danger of iodine poisoning, which may prove fatal in a few hours after symptoms of collapse (especially when watery solutions have been used). Grave alcohol poisoning and unconsciousness of several days duration have been observed after the use of alcoholic solutions. In other cases the injection was followed in ½ to 2 hours by a chill, the patient became cold, the pulse small and frequent. At the same time appeared terrible vesical tenesmus which lasted for hours, with scanty secretion, nausea, vomiting, iodine taste in the mouth, iodine odor in the expired air, and xanthopsia. The excretion of iodine in the urine could often be demonstrated chemically for weeks. Death sometimes occurred as late as 8 or 10 days after the beginning of these symptoms.

A very serious objection to the injection of iodine is the fact that good results can only be hoped for in unilocular cysts. Cases are said to have been observed in which it was followed by the separation of a series of "daughter cysts" from the inner surface of the main cyst. Indeed, enthusiastic advocates of iodine injections even hoped that repeated injections into different cysts would produce absorption and shrinking of the partition walls of multilocular cysts. But even Boinet has recently restricted iodine injections to unilocular cysts with serous and purulent contents, and, since then claims to have secured recovery in 90 per cent. of the cases. Recovery after iodine injection is not always the result of simple shrinking but often of suppuration of the cysts with all its dangers. The subsequent employment of drainage was therefore often rendered necessary. In the majority of cases which were reported as cured, it is probable that the secretion of the cyst wall was merely diminished or abolished for a time. There was, perhaps, a slower reaccumulation of fluid or the tumor remained stationary for a long time.

Injections of iodine are extremely uncertain in their effects, only available in the most favorable cases, and in these are more dangerous than ovariotomy. Hence they have been entirely abandoned as a radical method.

At the present time they are only employed in combination with vaginal drainage. The injection is made by means of a funnel apparatus, whose rubber tube is connected with a Thompson trocar, or, after the cyst is opened by other means, with a simple glass tube. The pressure may be regulated by raising or lowering the funnel and the concentration of the injection fluid may be regulated by the subsequent introduction of an iodine solution.

Injections of other irritant solutions, such as sulphate of zinc, nitrate of silver, liq. ferri sesqui-chlorid, and alcohol, have beeen made much less frequently, and the results have been even more unfavorable than those of iodine injections.

III. *Methods which purpose the evacuation of the cyst contents into the abdominal cavity.*—Starting from the experience that in some cases of spontaneous rupture, or after accidental bursting of a cyst during examination, reaccumulation does not occur, the attempt has been made to produce such conditions artificially.

Excision of a portion of the cyst wall.—A long incision into the abdominal walls was made, the cyst punctured, and in order to prevent the reclosure of the puncture opening, a piece of the cyst wall was excised. The abdominal wound was then closed. If special consideration is not paid to the character of the cyst contents, this plan is extremely dangerous, and may result in peritonitis or the development of metastases in the abdominal cavity. One of Wilson's patients died of internal hemorrhage. Spencer Wells has recently resuscitated this method, but he restricts it to small, unilocular cysts with thin walls and perfectly clear, serous contents, which are inserted upon a broad base without a true pedicle (intra-ligamentary). A round piece of the cyst wall about 3 cm. in diameter, is excised, the tumor is completely evacuated, and, after ligature of bleeding vessels in the walls, the abdominal cavity is closed. Spencer Wells claims to have obtained a number of excellent results in this way.

Guérin and Tilt endeavored to effect the same object by means of subcutaneous incision of the cyst wall with a tenotomy knife. Relapses occurred in one of Maisonneuve's cases. Without previous puncture, the subcutaneous incision is an operation in the dark. We run the risk of evacuating infectious fluid into the abdominal cavity, and, in addition, are apt to injure large vessels.

A more rational method was recommended by J. Simpson. He first convinced himself, by the aid of puncture, of the character of the fluid. If it consisted of clear serum, he removed the trocar, and, during the next few days, attempted to prevent closure of the trocar wound by pressure on the cyst, or, if this proved unsuccessful, made a small incision through the abdominal walls and punctured the cyst with a thick, quadrangular trocar in order to produce a cross-shaped opening, which was less apt to close spontaneously.

Noeggerath has raised bi-manual rupture of small cysts, which had not attained the size of a hen's egg, into a sort of method, and claims that he has never observed any bad results. In the hands of inexperienced physicians this plan is as uncertain as it is dangerous, since we are never able to determine the character of the cyst contents, and extremely infectious tubal sacs may be mistaken for ovarian cysts.

IV. *Ligature of the vessels of the pedicle* was recommended by Hartwich, Richardson, Tanner and Autal, in order to produce shrinking, from diminution of the blood supply, of tumors which could only be removed with great difficulty. Freund adopted this method in a tumor which had been frequently punctured, and whose extirpation appeared inadvisable on account of strong pelvic adhesions; the pedicle had been felt per rectum. Freund made an incision 3″ long to the right of the linea alba, and from its upper end made a short transverse incision towards the outside. The pedicle was doubly ligated with catgut by means of a long curved needle. The patient left the bed 10 days later, and considerable shrinking of the tumor occurred.

This plan is of more theoretical interest than practical utility, inasmuch as the tumor may also be nourished through the medium of the adhesions. Furthermore, the vessels of the pedicle cannot be reached separately in those very cases in which extirpation seems impracticable.

OPERATIONS FOR OVARIAN HERNIA.

Of the various kinds of ovarian hernia, inguinal hernia alone possesses any great practical importance.

Congenital ovarian hernia is often bilateral. The process appears to be similar to that which occurs in descent of the testicles. If portions of the Wolffian duct and gubernaculum Hunteri are retained, the ovaries pass through an open processus vaginalis of the peritoneum into the inguinal canal and as far as the labia majora. In accordance with this mode of origin the ovary, in congenital inguinal hernia, is firmly adherent to the posterior wall of the hernial sac with quite a broad base, and cannot be replaced. The fimbriated extremity of the tubes almost always comes down with the ovaries. Congenital ovarian hernia is not infrequently associated with other developmental anomalies of the sexual organs, such as imperfect development of Muelier's ducts, the presence of a rudimentary horn of the uterus in the hernial sac, occlusion of the vagina, hermaphroditism.

In acquired inguinal hernia the ovary is generally quite freely movable on an elongated ovarian ligament. The ovary often comes down alone, *i.e.*, without the tube, but it may also draw the uterus after it. The omentum or a loop of intestine is often found in the hernial sac.

When situated in the inguinal canal or the labia majora the ovaries are greatly exposed to external injuries. Our first object should be to protect them against such injuries. Reposition and retention by means of a truss are only practicable in acquired ovarian hernia, with long mobile pedicles. In congenital hernia, on the other hand, the ovaries can be removed from their improper position, which has become relatively normal, only after intolerable traction. Hence, hardly anything can be done except to protect them from mechanical injury by means of soft cushions, and in many cases even such an apparatus is not tolerated.

Ovarian herniæ not infrequently give rise to very notable disturbances and violent pains by enlarging into tumors from the size of a walnut to that of a hen's egg during the catemenial congestion. Wandering pains or various reflex neuroses may even appear in the intervals. Such recurrent inflammations and nervous disturbances have repeatedly furnished the indication for unilateral or bilateral extirpation of the displaced organs. The indication may become especially imperative when, as in Werth's and Leopold's cases, there was also rudimentary development of the uterus and vagina. The operation then possesses the significance of castration.

Inflammation of ovarian hernia may run its course with the same symptoms as incarcerated hernia. The local tenderness of an irreducible hernia becomes associated with the sympathetic symptoms dependent on peritoneal irritation. The pain radiates towards the gastric region and internal sexual organs, and occasionally has the distinct character of labor pains. The patients complain of nausea, and often of vomiting. As the bowels may be constipated from one or another cause, herniotomy has sometimes been made for supposed incarceration of the intestines, and the fimbriated extremity of the tube has been mistaken for the omentum even during the operation. If the diagnosis of inflamed ovarian hernia is assured, we must confine ourselves to local antiphlogosis so long as inflammatory symptoms continue. If an abscess forms exit must be given to the pus by careful incision layer by layer. Compared with these usually catamenial inflammations of the ovary, true incarceration, in which a long ovarian pedicle is constricted, is extremely rare. Even in the latter cases we have to deal with a primary inflammation at the period of menstruation. The inguinal canal then becomes relatively too narrow for the swollen ligament. The ovarian pedicle becomes constricted and this may intensify the primarily inflammatory disturbances of circulation within the ovary into necrosis.

A further indication for operative interference is furnished by tumors which, as in incomplete descent of the testicles, appear to be favored by abnormal position in or in front of the inguinal canal. Among the 38 cases of ovarian hernia collated by Englisch, cystic degeneration of the ovary was found in 5 cases, cancerous degeneration in 1 case. Klotz has described a very interesting case of ovarian cyst in an hermaphrodite.

The operation for incarcerated ovarian hernia does not differ essentially from ordinary herniotomy.

The hernial sac is laid open by dissecting layer for layer, and then the neck of the hernia is dilated with the herniotome. If the ovary does not present very advanced changes it may be replaced. In one case Bryk was compelled to separate the adherent right broad ligament and remove an hydatid as large as a nut before he could replace the contents of the hernial sac (uterus and both ovaries). He then dissected out a piece of the sac 25 centimeters square and sewed together the inguinal ring, in order to prevent the reappearance of the hernia. But if the inflammatory changes are very advanced, or necrosis of the ovary has occurred, it should be extirpated. In a case reported by Balleray, who replaced the ovary (which had been incarcerated by a transverse, fibrous band) although the hernial sac contained 4 ounces of brownish yellow serum, a violent peritonitis set in. Even when the hernial sac is opened on account of supposed incarceration and simple inflammation of the ovary is found, it is best to remove the inflamed organ (which is always threatened by fresh inflammations) instead of contenting ourselves with simple division of the hernial sac which is filled with inflammatory transudation.

General recommendations alone can be made concerning the performance of extirpation. The operation will vary according as we have to deal with an ovary of normal size, or a tumor with a long movable pedicle, or with a short, broad insertion, and according as we find protrusion of the ovary alone or associated with other organs. After opening the hernial sac the pedicle, which consists of the broad ligament or of this part combined with a tube and even a horn of the uterus, must be perforated, and, according to its width, must be ligated in two or more subdivisions. Ligature with silk or elastic ligatures requires great care, since they are very apt to slip off, on account of the shortness of the pedicle and its tendency to slide towards the abdominal cavity. Above the ligatures and at a sufficient distance from them the ligated portion is either simply cut off or burnt off with the actual cautery.

The question of the mode of treatment of the pedicle answers itself with regard to congenital herniæ, which are connected by a short pedicle with the posterior wall of the hernial sac. Long movable pedicles have been often fixed in the external wound, especially in order to be able to control secondary hemorrhage. But if ligation has been properly performed and all morbid products removed, the disinfected pedicle may be replaced. Nor is drainage of the hernial sac absolutely necessary, if it has been thoroughly disinfected. The introduction of a drainage tube must always be preceded by the separation of the hernial sac from the general peritoneal cavity.

Both simple herniotomy and extirpation formerly gave very bad results in ovarian hernia. This was owing not alone to the absence of antiseptic precautions, but to the imperfection of the mode of operation, which was often improvised. Nearly half the cases collated by Englisch terminated fatally. The causes of death were generally peritonitis, phlegmons, which extended to the iliac fossæ and the region of the kidneys, or secondary hemorrhage. The recent publications report almost exclusively favorable results, and, in fact, these operations, with our present antiseptic and technical aids, can not be regarded as very dangerous.

CASTRATION.

DEFINITION, HISTORY AND LITERATURE.

Castration is the term applied to extirpation of healthy ovaries, or those which are degenerated but do not possess very large dimensions.[1]

Among the Oriental races certain operations on the external genitals, such as removal of the labia minora and clitoris, insertion of a ring between the labia majora, were often performed in ancient times. The Greeks and Romans applied to these operations and also to the removal of the uterus and ovaries, the terms: ευνουχισαι, castrare. But castration in our sense of the word was undoubtedly performed.

In recent times an English traveller, according to Bischoff, has seen female eunuchs in India.

Somewhat more reliable reports have been obtained concerning the castration of women among the Australians. Tillmans (*Ueber Præ-his-*

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[1] Many attempts have been made to confine the term "castration" to the extirpation of healthy ovaries, but this is not alone at variance with the ordinary use of language but also with the historical development of the subject. Veterinary surgeons apply the term to the removal of healthy and diseased ovaries, and in surgery castration means almost exclusively the extirpation of diseased testicles.

torische Chirurgie) makes some interesting statements concerning the operations performed by these savages.

The first accurate reports on the extirpation, for therapeutic purposes, of healthy, or, at least, not much enlarged ovaries, refer to organs which were situated in hernial sacs. The operation was almost always performed on one side alone. Pott is the only one who mentions a bilateral castration of this kind. Recent communications also refer chiefly to unilateral castration in ovarian hernia.

At the end of the last century Hunter proposed the extirpation of ovarian tumors in the beginning of their development. He said "there is no reason why women should not bear spaying as well as other animals." Despite the great spread of ovariotomy the removal of small tumors has been rare even in recent times.

In 1869 Koeberle removed a healthy ovary. He desired to replace the retroverted uterus permanently by fixation of the left broad ligament within the abdominal incision. The corresponding ovary was removed merely from technical considerations.

The idea of castration, based on the indications recognized to-day, was conceived by James Blundell. He studied abdominal surgery experimentally, and in 1823 made a report to the Royal Med. and Chirurg. Society of London. He claimed that the tubes, ovarian cysts, healthy ovaries, a cancerous or puerperal uterus, portions of the bladder and spleen, could be removed without destroying life. He proposed extirpation of the healthy ovaries as an efficient remedy in obstinate dysmenorrhœa and in menorrhagia from an inverted uterus, if the extirpation of this organ were refused.

Castration under other conditions was first performed in order to relieve the symptoms produced by disease of the ovaries. The first operation made for this purpose, in fact the first castration, was performed by Hegar on July 27, 1872. The indication consisted of intolerable dysmenorrhœa and ovarian neuralgia, on account of which the patient had contracted the opium habit. Both ovaries were removed, and showed degeneration of the stroma with small cyst follicular degeneration. The patient died of septic peritonitis. Battey did not perform his first operation until August 17, 1872.

If the operation was performed on account of pathological changes in the ovary and its results, unilateral castration as a matter of course was justifiable. One ovary was, therefore, removed quite frequently by Battey and Sims. This has often resulted in failure and has helped to discredit the operation. A mistake had been made in assuming only unilateral disease, or the source of the symptoms had not been recognized. These were not alone the result of disease of a single ovary, but were also dependent on other changes, especially inflammatory changes in surrounding parts, which, perhaps, were only curable by effecting cessation of menstrual congestion.

Operations based on anatomical changes in the ovaries showed that not alone may these organs constitute an irritant which gives rise to morbid phenomena, but that coincident pathological changes in surrounding parts, in the tube and broad ligament, are often present and not infrequently constitute the primary disease. These structures must then be removed, if possible. Hegar intentionally removed diseased tubes in his first operations, and from the start employed the term salpingotomy.[1]

Klotz not alone removed the ovaries and tubes, but even large portions of the ligament, and forcibly distended the remainder, because he properly assumed that the irritation in such cases also starts from the shrunken ligaments.

A second motive for castration lay in the purpose to cure various morbid conditions by causing cessation of the ovarian functions and the production of premature menopause. In such cases, as a matter of course, both ovaries are removed. This category includes almost exclusively anomalies or pathological changes in the other sexual organs or their immediate vicinity, *i.e.*, those parts of the body which possess a function in common with the ovaries. Thus, the abolition of ovulation was intended to relieve the results of certain developmental anomalies or acquired atrophies, and of stenoses or atresiæ of the genital canal. As a general thing we desire to induce the involution of the uterus which follows the menopause, hence the indications in hyperplasia of the uterus, anomalies of shape and position, and fibromata. In inflammatory conditions of the appendages of the uterus it was hoped that the cessation of the monthly congestion would terminate the continuance of the irritation and the tendency to relapses.

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[1] In the *Centralbl f. Gynaek,* Jan. 19, 1878, Hegar reported two salpingotomies which were performed on Oct. 19th and Nov. 18th, 1877. In his larger work on castration of women, which appeared in 1878, are given the details of two castrations associated with salpingotomy. Further proofs that Hegar not alone intentionally extirpated the tubes, but also employed the term salpingotomy, and discussed the indications and technique, are found in *Castration der Frauen.* pp. 112, 92.

Finally, a cure was sought for diseases, especially of a nervous character, which had no connection with the sexual organs, by the effects of the menopause upon the organism as a whole and upon the nervous system.

In recent times an attempt had been made to differentiate, according to the anatomical appearances, the various operations which have been grouped together under the generic term castration, oophorectomy. Hegar's or Battey's operation. In order to secure priority other names have also been given, based upon some untenable hypothesis, as, for example, that according to which the tubes, not the ovary, are the starting-point in menstruation (Tait's operation, extirpation of the uterine appendages). As a general thing, the tube had commonly been removed, especially in cases of fibroma, but this had been done for reasons other than those based on this peculiar hypothesis.

We consider it improper to differentiate, according to the anatomical appearances, the various operations, although they differ in certain respects. But we do believe that the extirpation of large tubal tumors and pyosalpinx should be kept separate. We have called attention, in the previous edition of this work, to the necessity of separating these operations from castration.

The latter operation has now obtained general support. Many attacks upon it constitute a reaction against the exaggerated expectations and praise of its adherents. Many of them arise from imperfect knowledge and false interpretation of the doctrines taught by the originators of the operation. At the present time we need only consider improvements in technique and a more precise differentiation of the indications.

SIGNIFICANCE OF BILATERAL CASTRATION.

The effect produced by the removal of a certain organ may be determined when we know the significance of that organ for the rest of the body. Erroneous views in this particular have obtained with regard to the ovaries. The old saying "*propter solum ovarium mulier est, quod est*" must at least be greatly restricted. The congenital absence or rudimentary development of both ovaries has often been found associated with a perfectly normal female type of body, even with well-developed breasts and external genitals and normal pelvis. Marked or even excessive sexual desire has been observed in some of these individuals, while in others it was wanting. Feminine characteristics have been expressly mentioned, and the male habitus is rarely noticed.

Imperfect growth of the bones and hence pelvic abnormalities, small size of the body, congenital narrowness of the large vessels, and heart lesions, cretinism and idiocy, other anomalies of the nervous system, in fact, signs of defective development, are associated not infrequently with absence of the ovaries, but are by no means constant. On the other hand, the uterus and tubes were absent or at least rudimentary, without a single authentic exception. The vagina may be well developed, imperfect or entirely absent. In rare cases the external genitals are poorly developed. In unilateral absence or rudimentary development of the ovaries the uterus is often rudimentary or only one horn is well developed, while the other, corresponding to the absent or defective ovary, is also absent or present only as a rudiment. This dependence of the uterus on the ovary is also manifested in transverse hermaphrodism. In so-called female transverse hermaphrodism (with ovaries) the uterus is constantly present, despite the male type in other respects. In masculine transverse hermaphrodism (with testicles) the uterus is absent (with a few exceptions) despite the often very decided female type.

In the absence of the ovaries or their rudimentary development menstruation is abolished. This is not the result of the associated absence or imperfect development of the uterus. Nor are there any molimina or vicarious manifestations, while these usually appear, and often to a very marked extent, in individuals who possess functionating ovaries, but no uterus or a rudimentary one.

A consideration of the anomalies in question therefore favors the view that the development of the tubes and uterus depends upon that of the ovaries, and that the one great function of the sexual organs, *viz.*, menstruation, depends upon the function of the ovaries. The general structure of the body, pelvis, breasts, external genitals (even the vagina), sexual desire and the mode of feeling, are independent of the ovaries or only relatively dependent on them.

The effect of extirpation of the ovaries during childhood is unknown, at least the statements in this respect are incomplete and doubtful.

Roberts, an Englishman, claims to have seen, in East India, female eunuchs who were large and muscular, and destitute of breasts, nipples, and a vulvar fissure. The pubic arch was so narrow that the rami were almost in contact. There was no deposit of fat around the genitals. The buttocks were not more developed than in men. Menstruation never occurred.

If young female animals are spayed, the constant results observed are a more quiet temperament, a tendency to the deposit of fat, and cessation in the growth of all parts of the genital canal. Heat does not occur. Nothing further is known concerning the effects on the bodily type.

In older animals the favorable effects on more ready fattening and on lactation are more doubtful. Heat ceases almost constantly, and the exceptional cases are attributed, by veterinary surgeons, to incomplete extirpation and to morbid conditions in the sexual organs and surrounding parts (for example, garget).

In adult women the function of the ovaries is abolished, or, at least, greatly restricted during pregnancy, and probably often during lactation. Upon this fact the amenorrhœa probably depends, although other factors may also come into play. Amenorrhœa is a usual result in pathological conditions, which are associated with complete degeneration of both ovaries. The exceptions may be attributed to persisting healthy parenchyma, collateral fluxion and stasis, the latter, particularly, when the type of hemorrhages is not completely retained. In many cases, however, the amenorrhœa may be attributed to the coincident disturbance of the general nutrition.

At the natural menopause the ovary atrophies and it is not improbable that this atrophy precedes that of the uterus, inasmuch as the ability of conception is decidedly diminished in the 4 to 8 years preceding the menopause. Although other factors may also be concerned, the assumption of a development of the ovum, which is insufficient for impregnation, offers a ready explanation.

With the cessation of the menses we notice very frequently a series of annoying complaints or morbid phenomena. The most common ones are symptoms of a congestive character, or vasomotor disturbances, such as sudden redness of the face and neck, sudden general or partial diaphoresis followed by a tendency to chill, headache and vertigo, a feeling of oppressive pain in the back, pressure and wandering pains in the pelvis.

In addition, hyperæsthesia, itching and burning in the skin, usually confined to individual parts such as the palm of the hands and soles of the feet, a tendency to neuralgias, depression, nervous excitement, insomnia. Disturbances of the digestive organs, anorexia, constipation or diarrhœa, nausea and vomiting, are not infrequent. Hemorrhages, from various organs, the nose, lungs, intestines, urinary passages, and cutaneous eruptions are observed in rare cases.

As a general thing all these symptoms are irregular and atypical, but they are usually marked at the menstrual periods, especially at first.

In many cases the menopause does not appear suddenly. Some menstrual periods are skipped, then an often copious discharge appears at a later period. Irregular hemorrhages are not infrequent and sometimes last for a long time. These are often owing to previously existing pathological conditions of the uterus, especially hyperplasia of the muscular coat and connective tissue. But such etiological factors may be absent. An acute (probably in great part congestive) swelling of the uterus is sometimes noticed during the course of the menopause.

In addition to the gradual (sometimes quite rapid) diminution in the size of the uterus, which is often attended with atrophy of tumors, we also observe atrophy of the tubes, the external genitals lose their cushion of fat, the labia majora become flabby, and finally constitute mere folds of skin. The vaginal walls lose their firm structure, become anæmic and flabby. We not infrequently observe a kolpitis, in which the portio vaginalis takes part. Its genesis is not well understood, but the predisposition to it is probably owing to the structural changes and modified circulation of the vagina which occur at the menopause. Perhaps the increased patulousness of the entrance to the vagina favors infections. Redness and swelling of the entire vagina, with a few shining red points, or hyperæmia in patches, with anæmic, pale islets, and purulent secretion, are observed. The introitus is usually affected in the same way. The process is often severe, the swelling and redness intense, the secretion profuse, purulent, and even tinged with blood. The process often becomes chronic. Adhesions form between the portio vaginalis and the fornix. The submucous tissue becomes affected. Retractions, narrowing of the introitus and even the entire vagina, which becomes conical above, make their appearance. Or the retraction is partial, and the vagina then contains firm bands and even presents annular strictures.

Such retractions may develop, even when kolpitis is absent or only moderate. The final result of the climacteric changes of the vagina varies, and we find manifold gradations from a flabby vagina with a tendency to prolapse to a narrow contracting tube.

The above-mentioned symptoms of the menopause, which may remain within physiological bounds or border on the pathological, undoubtedly are due to various causes. The most important factor is the cessation of an habitual hemorrhage. *A priori* it is not probable that the anatomical changes, especially the dilatation of the vessels, which must have finally developed during the 35 years' duration of the menses, can be rapidly removed in all individuals. In many compensation will soon set in, in others it will not. In the latter marked stasis of blood (pressure and a feeling of weight in the pelvis, molimina, turgescence of the uterus, kolpitis) will develop, and hence local and reflex symptoms. In some these symptoms will be milder, in others they will be more prominent, particularly when other complicating pathological changes are present. If the congestion of the vessels is very pronounced, extravasations may occur and bloody discharges are then observed. These may assume a periodical character, such as are even observed in men suffering from pelvic stasis. This explains the periodical hemorrhages in women who have long passed the menopause. Pathological processes in the sexual organs, such as polypi, beginning carcinoma, tuberculosis, tumors, or affections of other parts which produce circulatory disturbances (diseases of the heart and liver) have been recognized as further etiological factors.

In rare cases regular menstruation seems to have resulted from recurring ovulation. At least, this is the only way in which we can explain the conceptions which sometimes occur after such a return of menstruation. Perhaps the stimulus of coitus has produced the new vital function.

Among the more remote results of the menopause have been mentioned certain changes, which partly refer to a blending of the sexual type, partly possess a different character. The latter include the by no means constant tendency to embonpoint; the former include the growth of hairs in the face, the deeper voice, the change of ideas, and of the mental and emotional life of the woman. Analogous symptoms have been observed in animals. Hens, especially the pea hen, are said in many cases to assume the male habitus, particularly with regard to the feathers, after the cessation of ovulation. The antlers of the doe are said to become better developed.

But the changes mentioned above are very inconstant in women after the menopause, and are rarely pronounced. The influence of the ovaries on the entire organism is not as unbounded and direct as was formerly supposed, and in addition the rigidity and firmness of the tissues peculiar to the age of the individual would present considerable resistance to such changes

We need only consider the conditions which obtain during and after the menopause in order to recognize all the consequences of extirpation of both ovaries.

In the large majority of cases, the menopause sets in immediately after the operation, or after a few, partly periodical, partly irregular, hemorrhages. In rarer cases a periodical hemorrhage continues; irregular discharges of blood are more frequent. The explanation of these facts is usually easy. Incomplete extirpation and the presence of a third ovary are less frequently at fault than is generally believed. A greater influence is probably exerted by vascular dilatations, stasis and hyperæmia of the pelvis, such as are often present before the operation or may develop later. This is a not infrequent result of great relaxation of the abdominal walls, which is almost always associated with a similar condition of the walls of the veins, and gives rise to diminution of the intra-abdominal pressure and greater fullness of the pelvic vessels. More pronounced pathological processes, such as inflammation of the pedicle, ligaments, other parts of the pelvic peritoneum and connective tissue, tuberculosis, produce periodical or irregular hemorrhages, partly by a direct influence on the circulation, partly by nervous agency.

After bilateral ovariotomy, *i.e.*, the extirpation of large tumors, the continuance of menstruation has been observed more frequently than after castration. This may be the result of various circumstances. The vessels are generally more numerous and larger. Mistakes may have been made in many cases. The tumor on one or the other side did not develop from the ovary. For example, a third truly ovarian tumor has been removed at a subsequent period. Even pregnancy has been observed after double ovariotomy. However, the cases of complete amenorrhœa are much more frequent than those of continuance of menstruation. For example, Krassowski observed cessation of menstruation constantly after 12 bilateral ovariotomies.

Atrophy of the tube and uterus, and the changes in the vagina, occur after castration in the same way as after the natural menopause. Very rapid atrophy of the uterus, even to the size of a walnut, has been observed not infrequently. The rapid atrophy of fibromyomata has also been noticed. This is undoubtedly owing, in great part, to the removal of the ovary. The dependence of uterine development on that of the ovary, the analogous atrophy of the excretory duct after the removal of other glands, testify in favor of such a connection. But the obliteration of the vessels and the thromboses, which are the direct result of the operation, must also be taken into consideration.

In some cases we have found an intense degree of climacteric kolpitis. The local symptoms, the consensual and reflex phenomena, are exactly similar. A certain tendency to embonpoint is undeniable in many persons. Other results, such as the growth of hairs, deeper voice, and changes in the mental and emotional condition, have not been observed. Sexual desire is often retained, but the opposite has also been noticed.

According to our present experience it is impossible to state, in figures, in how far disagreeable symptoms are more frequent after the artificial than after the natural climacteric, or whether the conditions as regards bloody discharges are very dissimilar. It would seem, however, as if the latter disturbances are more frequent after the artificial menopause, and also that the other symptoms are more numerous and severe. This is very easily explained. The artificial climacteric is always preceded by local pathological processes, often of a very pronounced character. Moreover, the nervous system is often affected, so that the vasomotor disturbances and other symptoms starting from them are apt to be more intense.

The operation itself produces abnormal conditions, by the ligature of vessels, thrombosis, adhesive or retraction processes, etc. Furthermore, the ovaries are suddenly extirpated. If these facts are taken into consideration, the development of morbid phenomena should be assumed *a priori*, and it is astonishing that the subsequent course of events is so often undisturbed.

The significance of bilateral castration from a physiological standpoint may be very briefly expressed. The climacteric is precipitated. Sterility is a certain result. But if we take into consideration the morbid conditions on account of which castration is performed, it is evident that sterility need not be produced inasmuch as it is already present. The *facultas concipiendi* is very often absent or is very doubtful. In some individuals it is present, or, at least, only impaired. But the *facultas gestandi*, the power of carrying pregnancy through to full term, is absent, or, at least, very problematical. Finally, conception and even the completion of pregnancy are possible. But the condition of the patient is such, that this eventuality is not even desirable. In doubtful cases the individual circumstances must be taken into consideration. Other factors, besides those which are purely medical, come into play, and may influence the decision of the patient and her family. It is the duty of the physician to explain thoroughly the results of the operation.

While castration destroys the *facultas concipiendi*, the *facultas cœundi* is retained. The results of castration in the female are entirely different in this respect from those of the corresponding operation in man. In the latter the ability to perform sexual intercourse is almost always lost. But we must not fail to mention that the kolpitis, the shrinking and narrowing of the vagina and introitus, interfere with coitus and may even render it impossible. But this may be readily relieved by proper treatment. In some cases, for example, in prolapse of the ovaries, and perioophoritis, coitus, which had been impossible on account of pain, may again be performed after castration (L. Tait).

The retention of the ability to have sexual intercourse also explains the fact that the mental depression, melancholia and even suicidal tendency, which occur in men after castration, are never observed in females. Fissier adduces another cause for this difference. The mutilation is not visible and its entire significance is not recognized, because the illusion is not disturbed by constant inspection.

J. Williams, Note on the Involution of the Puerperal Uterus in the absence of the Ovaries, (*Amer. Journ. of Obst.*, 1884, p. 778.) Interesting case. The left ovary had been removed previously. The right cystic ovary was extirpated during labor. Favorable convalescence. Involution occurred with abnormal slowness during the first seven weeks, but at the end of seven months the uterus was smaller than in the virgin.

Conditions and Indications.

In patients who are near the natural climacteric, the operation is not justifiable if the abolition of the sexual functions and the retrogressive involution of the sexual organs are relied upon exclusively as the means of cure. A different aspect is presented when the ovaries and their immediate vicinity are diseased in such a way that their removal *per se* is necessary to recovery, while the abolition of the sexual functions would have no curative effect on the condition.

A second condition is the previous palpation of the ovaries, and the recognition of their structure and insertion. It is only in cases of fibroma that exceptions appear to us to be justified. In such cases the ovaries are raised not infrequently towards the abdominal cavity by the tumor, which has developed in a part of the uterus situated below the ovarian ligament. At the same time they may be pushed backwards by the tumor, which has grown chiefly in the anterior wall of the uterus. The mesentery of the ovaries may be unfolded or very short; so that, being situated directly on the tumor, they possess only sufficient mobility to be pushed to and fro upon it. Under such circumstances they can often be found with difficulty or not at all. It is also possible to mistake them for fibroid nodules. Nevertheless, the organs can often be recognized by combined examination or simple abdominal palpation. Their peculiar consistence, the finely nodular surface and flat shape almost always secure us against mistaking them for small, sub-serous fibromata. The most careful examination should be made, inasmuch as the advantages of a previous diagnosis are often very great; without it, we often risk an exploratory incision, or are forced to perform an entirely different operation from the proposed castration.

The recognition of the ovary in the small tumors, grouped in various ways, which are the results of combined affections of the ovary and tubes, is often very difficult but possesses little significance. As the conglomerate must be removed *in toto*, the connection of the whole with the uterus, ligaments, etc., must be previously ascertained.

But we know of no other disease in which it is allowable to disregard this condition. In all other cases the ovary can be found within the pelvis. In the majority of instances in which the operation was abandoned or performed only partially, this was owing to the fact that the condition in question was disregarded.

The third condition is the absence of a very recent, acute inflammation. We do not deal here with septic processes or those which exhibit a tendency to sepsis, such as occasionally necessitate ovariotomy. But if such a process (which has never been taken into consideration hitherto so far as regards castration) should develop, the condition in question would have to be discarded. Other immediate dangers to life, which also justify a disregard of this condition and necessitate immediate operation, will rarely occur as indications for castration. The inflammations referred to here are sometimes quite acute, but circumscribed. The operation may then be delayed. If we do not wait too long, the adhesions will not be too firm, and we derive the great advantage of not finding a recent transudation, which exhibits a tendency to decomposition, or spongy, congested ovarian tissue.

It is still difficult to formulate the indications for the operation. Theoretical deductions first led to castration. The experience hitherto gained has confirmed the general correctness of the deductions. But the application of theoretical principles to concrete cases is attended with great difficulties, on account of the varying conditions and usually numerous complications. The abundant material of the last few years has shed a clearer light on the subject, so that a more precise formulation of the indications appears possible. But careful reports of cases and particularly the determination of certain physiological and anatomo-pathological conditions are necessary for further progress.

Castration produces curative effects in two ways, either by the removal of a degenerated organ which acts directly as a source of irritation, or by the results of the abolition of the ovarian functions, the so-called artificial or premature climax.

In the former event the ovary usually presents considerable pathological changes and forms the centre of irritation. But the adjacent parts, the ligament or tube, may be affected primarily to a marked degree. The ovary, which is affected at the same time and almost always severely, is removed partly on this account, partly for technical reasons. It is also removed for the reason that its retention, for example, in pyosalpinx, would be useless and would only act injuriously. In operations of this kind ovulation also ceases, but this is not the means through which we seek to act. The diseased part would have to be removed, even if it were unconnected with ovulation, and the artificial climacteric is merely an accident. Very many castrations belong in this category, such as those performed on account of small tumors, small cyst degeneration of the follicles, and degeneration of the stroma.

Our justification for assuming curative effects from the artificial menopause, is based upon what we know concerning the influence of the abolition of ovulation upon the other sexual organs. We employ this influence to cure pathological changes in the latter or to remove their consequences. The influence of the premature menopause on the organism in general, particularly the nervous system, has also been sought in the cure of certain diseases, especially of severe neuroses, *i.e.*, in cases in which the pathological phenomena were not connected with morbid changes in the sexual canal, and at the most, the attacks occurred during menstruation or were very violent at such times. We believe that the indication based on this view—which was first formulated, though with great caution, by Battey—is unwarranted.

The co-effects of castration, which in themselves are insufficient to justify an indication, consist of the stretching of retracted ligaments, and hence of the nerves contained in them, of the rupture of adhesions, and of the freeing of organs, such as the uterus and bladder, which are imbedded in inflammatory products. These effects are partly produced unintentionally during the operation, in part they are produced designedly by vigorous traction and even tearing. Klotz even excised large portions of the broad ligaments.

An entirely unexpected effect on acute or chronic inflammatory processes has been occasionally observed. This could be attributed neither to the removal of a focus of irritation nor to the production of the artificial menopause, as the removal of both organs was performed incompletely or not at all. Thus, very great improvement or even cure was observed in diffuse peritonitis, especially the granular form with abundant exudation. This is also true of circumscribed peritonitides such as are observed in connection with small ovarian enlargements or salpingites, even when the intended removal of the new growths or the retention-tumors was not successful, or only in a slight degree. In some cases the favorable results seem to have been effected by the formation of an abscess, which is known to be often attended with softening of hard masses of exudation. When suppuration has not occurred, the operation may have acted like any other recent irritation in chronic inflammations, inasmuch as the acute process introduced a softening of the firm exudations and increased absorption. The simple evacuation of the free or encapsulated, purulent or non-purulent exudation occasionally acts very favorably in granular peritonitis. The effect may also be due solely to the abdominal incision. As we see, the causal connection between the operation and improvement is sometimes difficult to ascertain in such cases, although the fact itself is undisputed.

As a matter of course, no indication can be based on such data.

The opponents of castration, in order to explain its undeniable curative action in neuroses, have attributed it in great part to the action on the mind.

We do not know whether the advocates of this opinion have concrete cases in view. We know of no cases in our own experience in which such an explanation is probable, nor have we found any in the literature of the subject. *A priori* such views are often very probable. But we must be on our guard against upholding them without sufficient observations, and especially against making generalizations. This would not be justified even if a few proofs were forthcoming. Without denying entirely that the psychical effect perhaps plays a certain part, perhaps even the chief part, in some cases of cure, this is opposed by very weighty reasons in a large number of recoveries. When the effect was immediate, *i.e.*, the symptoms disappeared at once (as happens not infrequently), certain symptoms have also disappeared whose removal could not be explained by psychical agencies. In many instances the purely nervous symptoms, whose relief could be explained by psychical influences, reappeared some time after the operation, *i.e.*, at a time when the psychical influence could no longer exert an effect. For example, we have sometimes noticed that the neuroses were not cured until the disagreeable symptoms, produced by the climacteric, had subsided, even after the lapse of a year.

Starting from the possibility of recovery by psychical influences, pretended castrations have been made, and Israels' case particularly has produced much stir. This case of recovery, which was reported even in the newspapers, is founded on a mistake. The patient in question retained her nervous vomiting, as was proven on her reappearance, on two occasions, in our clinic. It is a remarkable fact that this asserted case of recovery still haunts our literature. It is very doubtful whether it is at all justifiable to deceive patients in this way. Apart from the ethical standpoint, it seems to me that the injury caused by the loss of faith in the truthfulness of the physician is greater than the advantage derived in perhaps a few, but at all events exceptional, successes. The trick cannot be played for a long time, inasmuch as those who are adapted to such treatment soon become enlightened.

In order to avoid unnecessary repetition we will formulate a general indication, and will take this for granted in describing the individual indications.

Castration is indicated in anomalies and diseases of the sexual organs which cause immediate danger to life or terminate fatally in a short time, or are followed by long-continued, progressive illness, which interferes with the enjoyment of life and ordinary duties. At the same time it is presupposed that all other milder methods of treatment would either prove useless or had been tried unsuccessfully, while the removal of the ovaries would relieve the disease.

The individual indications depend on anatomical changes in the sexual organs and surrounding parts. But such changes *per se* very rarely necessitate the operation (for example, in malignant tumor), and only when they have given rise to dangerous or extremely annoying sequelæ. Apparently identical anatomical changes often are attended with very different consequences, sometimes giving rise to violent symptoms, at other times to very mild or no symptoms. The same name is often applied to various conditions which may possess certain similar attributes but may differ essentially in other respects. To our incomplete knowledge of the finer pathological anatomy of the genital organs, especially the ovary, it is often to be attributed that we are able to distinguish such differences very imperfectly or not at all, in the living subject and even in anatomical preparations. Complications are often effective in the genesis of symptoms, and compensations are also possible. The same pathological change may be present in two patients, but in one the evil results follow, in the other compensation occurs, so that no symptoms are produced. Without assuming such a compensation it would be difficult to explain, for example, why severe symptoms appear in one individual with a rudimentary uterus and functionating organs, while they remain absent in another suffering from the same anomaly.

The symptoms which accompany the various pathological changes under consideration have much in common. From the symptoms alone we may generally draw an approximate conclusion concerning the anatomical changes. The symptomatology has been neglected in comparison with physical diagnosis, although more careful study of the former might furnish important data concerning the relations between the individual anatomo-pathological conditions and the symptoms dependent on them.

We will first take a general view of the symptoms which may individually (but almost always in groups) form the cause of castration. As many of these symptoms may also result from other than diseases of the sexual organs, the proof of a causal relation between them must be especially considered.

In the first place we note symptoms which depend on disturbance of the functions of the sexual organs, such as amenorrhœa, dysmenorrhœa, irregular menstruation, retentio mensium, scanty menstruation, menorrhagia, membranous dysmenorrhœa, vicarious menstruation, hemorrhagic or other discharges in the intervals.

We also observe annoying painful sensations in the sexual organs, which are present constantly or temporarily during the intervals, and are considerably intensified during increased function of the genital system. Associated with these are the symptoms produced by direct influence of the diseased organ on adjacent parts, such as symptoms of pressure or the extension of irritation to the bladder, rectum, adjacent vessels and nerves, adjacent and remote parts of the peritoneum.

Very many symptoms, which accompany sexual diseases, reside in the branches of the lumbar and sacral plexuses, which originate in the centre of the genital nerves within the lumbar cord. These lumbar symptoms, which may also arise from other causes and do not accompany all sexual diseases, are: pain and tired feeling in the small of the back, pains in the iliac regions, shooting pains in the thighs and legs, paresis of the lower limbs, coccygodynia, anæsthesia or hyperæsthesia of the introitus vaginæ, disturbances in micturition and defecation, etc. These symptoms may result from direct implication of the corresponding nerves or they may be consensual in character. Entire complexes of the symptoms mentioned may be present, although the pathological process affects only single nerves. A symptom may also appear at a part so remote from the site of tissue-changes that the nerves of the former locality could not have been directly affected. Thus, disturbances of the bladder, ureters, etc., may be associated with callosities of the broad ligaments far removed from the site of the symptoms.

Then we notice symptoms in parts of the body and organs, which are so remote from the sexual apparatus that their reflex nature is sufficiently proven. For example, affections of nerves which start from higher parts of the cord (intercostal neuralgias, mastodynia) and organs which are supplied by the pneumogastric and sympathetic (cardialgia, vomiting, globus, aphonia, cough, asthma, delirium cordis). Among the cerebral nerves the trigeminus is often attacked (neuralgia), more rarely the facial (salivation.) In recent times many functional diseases of the eye and ear have been attributed to sexual disturbances. There is no doubt that the latter are connected with various cutaneous affections. Special interest attaches to vasomotor (hemorrhages, œdema, etc., in so-called vicarious menstruation) and trophic disturbances.

Finally, general nervous affections, neurasthenia, spinal irritation, hysteria, chorea, epilepsy, and even psychoses, have been attributed to sexual diseases.

The latter may act in various ways in giving rise to nervous disturbances. Their development is especially furthered by the weakness resulting from losses of blood and profuse leucorrhœa. The nervous affections may also result in a purely psychical manner, especially if the patient is unable to perform the marital functions, and is very much depressed in consequence. In very many cases the peripheral nerves of the sexual organs are at fault, and the emotional nature is affected later, often coincidently with the development of a general neuropathic condition.

It is extremely important, so far as regards treatment and especially castration, to determine whether the symptoms are due primarily to the sexual affection or what part is played by the latter in the symptomatology.

In arriving at a conclusion we must consider the location of the nervous symptoms, which, in sexual diseases, are apt to appear first in the nerves starting from the lumbar cord and then gradually spread further. Symptoms in more remote parts of the body or general spasms are preceded by an aura in the lumbar nerves. The neurosis is sometimes confined to that half of the body upon which the unilateral pathological change is found. Nervous symptoms in remote parts alternate with those observed in the genital organs. The symptoms are often found in those parts (stomach, breasts, larynx) which are closely connected physiologically with the sexual apparatus. Certain neuroses are frequent in individual morbid states: gastric disturbances in retroversions; iliac pain, which radiates towards the breast and shoulder, in inflammatory processes of the ovary and surrounding parts.

A not unimportant feature is the relation in time between the neurosis and certain phases of the sexual life. The nervous affection may begin at puberty or the menopause; it occurs only during menstruation or in the middle of the interval or during pregnancy, or it disappears during one of these phases. Sometimes the neurosis appears at the beginning of the anatomical changes, or of pronounced functional disturbances of the sexual organs, or both are due to some gross injury to the latter.

The neurosis is rarely proportionate to the intensity and extent of the pathological condition, it is often the very reverse. Certain irritant effects are absent in complete destruction of the ovulating tissue of the ovary, and in large tumors, which are situated entirely within the abdominal cavity.

Nervous attacks or painful sensations may be produced or inhibited by pressure or other mechanical actions on parts of the genital apparatus. This sign is especially important if it can be produced through the sexual organs alone.

An experimental demonstration is sometimes possible. The neurosis disappears after relief of a uterine displacement or change of shape, and returns with the latter.

We must always endeavor to determine the genesis of the symptoms, and particularly the special factor of the morbid process which gave rise to the first effect on the nerves. This alone will decide, with regard to castration, whether the operation will relieve that factor of the morbid process which produces the principal symptoms. These factors include the pressure of the swollen, displaced organ, exudations or tumors on the nerves or entire plexus, and compression in the interior of the tissue by cicatrices and retracting pathological products. Furthermore, we also observe traction of the uterine or ovarian ligaments, or combinations of pressure and traction in inflammatory changes of the ligaments, cicatrices of the cervix, endometritis and perimetritis (as the result of spasmodic uterine contractions). Finally, catarrh of the introitus and vagina, erosions and intertrigo may give rise to considerable irritation.

In determining the part played by the sexual disease in the symptomatology, we must employ the method by exclusion or ascertain the part played by other factors in the production of the symptoms. Especially important is the exclusion of those causes which, without being associated with the affection of definite parts of the body, may give rise to neuroses, especially those included under the terms neurasthenia, spinal irritation and hysteria.

Apart from the demonstration of the causal connection between the sexual affection and the neurosis, we must also determine whether the removal of the cause will relieve the resulting morbid condition. Neuroses not infrequently persist even after the primary causal factor has been removed. This is especially apt to occur when the nervous affection has lasted a long time. Pronounced implication of the entire nervous system, and the occurrence of the neurosis under the influence of various noxious influences, testify in favor of the view that unknown changes have taken place in the nerves and produced the so-called stability.

The anatomical changes which warrant castration are found partly in the ovaries, partly in their vicinity and in other parts of the sexual system.

The ovarian changes, which form an indication for castration, consist of small tumors and the affection which is attended by small cyst degeneration of the follicles, proliferation and retraction of the stroma. The uterine changes include congenital and acquired conditions, which render menstruation impossible or extremely difficult, while the ovaries are present and continue to functionate; furthermore, conditions which interfere not with the secretion of the blood, but with its discharge. Such conditions may also affect the vagina. Finally, uterine structural changes, especially fibro-myomata, hyperplasia of the connective tissue, anomalies of shape and position; chronic inflammations near the uterus, such as peri-oophoritis, salpingitis, perimetritis and parametritis.

1. *Small Ovarian Tumors.*—These include follicular cysts of more than the ordinary size, glandular cystomata, papillomata, malignant growths, dermoids, fibroids, small parovarian cysts.

The character of the tumor (papillary cystoma, cancer, sarcoma) sometimes requires the most rapid removal possible. But certain sequelæ must usually be present to thoroughly justify the operation—for example, violent neuralgias, produced by compression, projection of the tumor anteriorly above the edge of the broad ligament when the pedicle is tense, or the steady traction of a long pedicle if the tumor is very movable and situated in the abdominal cavity.

Or the operation is performed on account of severe pains from peritonitic irritation and adhesive peritonitis, torsion of the pedicle, dysmenorrhœa, consensual symptoms, such as cardialgia, profuse menses, even metrorrhagias. If these annoying or threatening symptoms are not present, the continued growth of the tumor itself may necessitate extirpation. Then the only remaining question is that of the proper period for operation. If the tumor possesses a good pedicle and sufficient mobility or has a broad base, so that the upper portion of the broad ligament alone is unfolded to a moderate extent, it is best to decide on an early operation. If we delay the conditions are apt to become less favorable. Partial peritonitides, adhesions, torsion of the pedicle, continued growth between the layers of the broad ligament, are not infrequent; when the conditions are unfavorable from the start and the operation is not apt to become more difficult, we may wait until the size of the tumors or the severity of the symptoms no longer permits delay.

2. *The ovarian affection attended with small cyst degeneration of the follicles, proliferation and retraction of the stroma.*[1]

This disease has sometimes been regarded as a serious condition, at other times as insignificant, or, at least, as a purely secondary process. The latter is undoubtedly often true.

All the processes which strongly affect the circulatory conditions in the pelvis, especially those which produce venous stasis, may give rise to the ovarian changes in question. For example, uterine displacements and tumors, flaccidity of the walls of the pelvis (when the walls of the veins are poorly nourished), and valvular diseases of the heart.[2]

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[1] These changes (cystic degeneration of the follicles, formation of blood cysts, thickening of the albuginea, proliferation and sclerosis of the stroma, formation of small fibromata upon and within the organ, retraction, compression and obliteration of the ovulating tissue, etc.) form the anatomical basis of chronic oophoritis. It is not infrequently the result of true inflammatory processes. But such changes also develop in other ways, though there may be intercurrent inflammatory processes. Ovarian displacements, passive congestions, anomalies during the retrogressive metamorphosis of the follicles, are genetically very important. But it will be advisable not to apply the term chronic oophoritis to a change whose origin is so obscure; inasmuch as this nomenclature is apt to lead to false pathological and therapeutical views.

[2] The marked dilatation of the veins of the ligaments has not attracted sufficient attention. It is much less distinct after death than during life. It is most pronounced in fibromata, and in one case it became necessary on this account to perform amputation of the uterus instead of the proposed castration. Veritable coils of dilated vessels lay between the uterus and ovaries. These were injured during

Next, the degeneration is produced by irritative and inflammatory processes of adjacent organs, the uterus, tubes, peritoneum or cellular tissue. It seems that the same process which causes retraction of the parametral cellular tissue, may extend along the ligament to the ovarian stroma, and there produce so-called chlorosis. Even in uterine fibromata the stroma of the ovary is not infrequently implicated, and the follicular apparatus considerably atrophied.

Apart from these secondary conditions there may be primary affections, which are associated with no other diseases, or, at the most, with slight peri-oophoritis. They may result from certain infectious diseases, particularly scarlatina, and from excessive or unnatural sexual irritation. But in some cases no cause is apparent.

The diagnosis is not especially difficult. We are usually able to feel the individual retention-cysts as irregularities or elevations on the surface of the enlarged organ; or a very hard, small body is palpated.

It is often difficult to decide whether the ovary, which has been found diseased on examination, is really the cause of the symptoms, which are often of a purely nervous character. It must be remembered that apparently similar anatomical changes may exist in the ovary without any symptoms. The primary or secondary nature of the changes should first

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the application of a double ligature, and the hemorrhage could not be checked without extirpation of the uterus.

Very marked conditions of this kind are also observed in conditions of poor general nutrition, imperfect muscular development, obesity, heart disease, relaxation of the pelvic walls, chlorosis, displacement of the uterus and ovaries. The so-called chronic oophoritis is then the result of venous congestion. Marked varicosity of the ovarian veins may even lead to almost complete atrophy of the organ. The diagnosis of such dilatations may be made during life,—poor nutrition, especially flabby muscles, varicose veins in the lower limbs, external genitals, and rectum, bluish color of the vagina and cervix, relaxation of the abdominal walls and uterine ligaments (unless there are intercurrent inflammatory processes in the latter), retroversion, and prolapse. Richel describes a doughy, fluctuating, poorly defined tumor at the side of the uterus, which he observed in the dead body.

Among the prominent symptoms are : pain in the back and groins, a feeling of heat, pressure and fullness in the hypogastrium. The symptoms are increased in the erect position. Emmet narrates that a patient, on standing up, felt as if something were about to burst in the pelvis. She suffered from nausea and fainted. Later she suffered from an haematocele; this was punctured and recovery ensued after suppuration of the sac.

be determined. In the former event, we must then decide whether some other source of the symptoms may not be present. In the latter event, we must determine the part played by the primary affection in the production of the symptoms, and to what extent the primary disease may be relieved, or, at least, its effects inhibited by the operation. This may be done occasionally by castration itself or some palliative method—for example, the relief of retroversion. Marked dilatation of the veins of the ligaments are relieved entirely or in part by the obliteration of numerous vessels and thromboses. If the primary affection plays the principal part in the production of the symptoms, and is affected very slightly or not at all by castration, nothing is gained by removal of the ovaries. This is often true of retracting peritonitic and parametritic processes, and in the ovarian disease resulting from valvular affections of the heart.

3. *Conditions of the uterus, which prevent the secretion of the menses, or make it extremely difficult, while the ovaries continue to functionate.* These conditions are chiefly congenital or depend upon imperfect development during puberty. They include absence of the uterus, rudimentary development, the persistence of the fœtal or child's type, and, finally, the so-called uterus pubescens. Puech applies the latter term to an organ whose shape resembles that of the virgin uterus, but whose size and weight are far less. In the two latter anomalies subsequent development is not impossible, and there can be no question of castration so long as the individual is at that age when further development is possible, and the measures which may produce it have not been exhausted.

The matter seems very simple in the other cases. But certain facts impose caution upon us. Thus, individuals who possess a rudimentary uterus and functionating ovaries, may present very slight or no symptoms. It has also been found that certain annoying symptoms may be experienced for years, but are well tolerated and have no specially injurious effect on the general condition. When severe symptoms, violent congestive conditions, hemorrhages from other parts of the body, œdema, serous transudations in the cavities, and finally grave neuroses, such as epilepsy and mental disturbances, are present, it is often doubtful whether other independent diseases or complicating developmental anomalies are not also present. Stenoses of the large vessels, congenital disease of the heart, abnormal position of the kidneys, imperfect development of the external genitals, ovarian herniæ, anomalies of the nervous system, deformities of the skeleton, defective development of the entire body, have been observed not infrequently. They show that the rudimentary development of the uterus often forms only a part of the abnormal condition. Hence other causes must be excluded before we proceed to a serious operation. Accidental complicating affections, which may give rise to similar symptoms, must not be overlooked.

If other causes have been excluded, we must seek for positive proof of the genesis of the symptoms from the anomaly of the genital system. The first appearance of the symptoms at the period of puberty, their periodical occurrence, at least in the beginning, the pains starting directly from the ovaries, and the tenderness on pressure are especially important. It may often be proven that the ovaries are really functionating. Their surface presents irregularities, small prominences and depressions. An enlarged follicle is felt occasionally as an hemispherical projection. One or the other ovary is enlarged periodically. More marked enlargement and tenderness coincide with more pronounced symptoms. This has been observed with special distinctness in ovaries situated in hernial sacs, but it may also be detected in normally situated ovaries on careful examination.

Acquired conditions of the uterus, which prevent menstruation, must be considered from the same standpoints. These include complete or nearly complete obliteration of the cavity from traumatism during delivery or after operations, atrophy after severe labors in consequence of losses of substance from the trauma itself, diphtheria. Atrophy of the uterus has also been observed after parametritides. Old, hard connective tissue exudations sometimes cause permanent amenorrhœa. In the rare hyperinvolution of the uterus, which develops without a severe puerperal affection, in the persistent amenorrhœa following violent emotions, injuries with concussion of the whole body, severe cold during menstruation, violent coitus, etc., the condition of the sexual organs and the part played by the uterus and ovaries are known too little to be taken into consideration here.

4. *Conditions of the uterus or vagina, which prevent the excretion of the menstrual fluid.* These include all atresiæ and marked stenoses of the genital canal, whether congenital or acquired. Castration need only be considered when the atresia can not be relieved or another suitable canal made. In truth, it would be difficult to find cases of this kind in

which castration is justifiable. If hæmatometra or hæmatosalpinx has developed, it will usually be difficult to find the ovaries. The danger of the operation would be greatly increased by this difficulty, by the often extensive inflammatory products, and by the blood sac itself. In the best event complete recovery would not ensue, as the collection of blood with its sequelæ would persist. Only one operation of this kind has been performed (*Kleinwæchter, Ztschr. f. Heilk.* 1884). The atresia was acquired; large urinary and recto-vaginal fistula; hæmatometra. Right tube healthy, left tube adherent to the ovary and distended (hydrosalpinx.) Ovaries in small cyst, follicular degeneration, peri-oophoritis, remains of exudation in the pelvis. Death from septic peritonitis. Kleinwæchter proposes that the hematosalpinx which may be present should also be extirpated. But we also find descriptions of complete or incomplete stenoses (especially of the acquired variety) in which an accumulation of blood does not occur although the ovaries undoubtedly functionate. The uterine structure is usually changed to such an extent, that the secretion does not occur on this account. Here the atresia *per se* plays no part, and these cases belong under the previous indication. On the other hand the atresia itself sometimes prevents the menstrual secretion. This is to be assumed, for example, in Fletcher's case, in which a woman of 22 years suffered from amenorrhœa without hematometra. The vaginal atresia, which was present, was relieved, after which menstruation and later pregnancy set in. Ficshl's interesting case (*Prag. Med. Wschr.* 1883, No. 12) also belongs here. The patient, aet. 27 years, suffered from congenital atresia of a portion of the vagina 3 to 3½ cm. long. No accumulation of blood. Five years after marriage symptoms began: pain and pressure in the head, formication in the hands, visual disturbances, rings before the eyes. This also shows the great difference in the relations of the anatomical changes to the symptoms. Particular circumstances, perhaps conditions which produce compensation, may prevent the effects of a very marked anatomical anomaly. Firm tamponing, or closure of the external orifice of the uterus with sutures, may materially diminish the menstrual secretion and occasionally even check it without causing any damage.

In the individual case it is often difficult to decide whether the absence of the menstrual secretion is the result of the atresia or of tissue changes. The latter is probable when the uterus is small, atrophic, very rigid and hard. The distinction is not unimportant in practice, since, in the latter event, all attempts to relieve the atresia would be unnecessary, and in the former event, the genital canal must be made permeable before castration is decided upon. In Battey's case of acquired atresia, in which the operation was performed, the uterus was retroflexed, adherent and small; no hæmatometra. The structural changes, which had developed after a very severe labor, were probably the cause of the absence of the menstrual secretion. The atresia seems to have played no part in the whole matter, although the case is usually mentioned as one in which the operation was indicated by the atresia.

5. *Diseases of the Uterus.*—These include chronic hyperplasiæ, with or without changes in the shape and position, chronic endometritis, and fibromata. With the exception of fibroids these conditions rarely produce direct danger to life, and only those cases need be considered in which the symptoms are extremely distressing and have a marked reaction on the general condition. In addition the ordinary remedies must have been employed without success. Much depends on the social position of the patients. The operation need rarely be performed on account of this indication in a patient who possesses the means of securing every comfort and attention.

The following are the reasons which have induced us to perform castration in myomata. In the absence or rudimentary development of the ovaries there is also absence or rudimentary development of the tubes and uterus. After castration of young female animals, the tubes and uterus cease to grow or even become smaller. Atrophy of the uterus has been observed after bilateral ovariotomy. As a rule fibroids do not grow after the menopause, and may even undergo retrogressive metamorphosis, at the same time the symptoms diminish or disappear. But there are also exceptions to this rule.

Experience has justified castration based on these premises. The results have been very favorable in myomata, though with some exceptions. The latter has also been observed with regard to the effect of the natural menopause on these tumors.

The manner in which the loss of the ovaries causes disappearance of fibroids or cessation of their growth, is not entirely clear. We may, indeed, call to our aid the general law that the abolition of the function of a part of the body also causes atrophy of this part. We know with regard to the glands (testicles, kidneys) that their removal or the abolition of their function, with the associated loss of function of their excretory ducts, results in their atrophy. But the causal connection is not clear, although the fact is undoubted. The cessation of the periodical congestion which occurs immediately or some time after the operation must be taken into consideration with regard to the uterus and tubes.

Castration is also effective on account of the ligature of the vessels incident to it. A part may here be played by the ligature of individual arteries, perhaps to a still greater degree by that of numerous veins and subsequent thromboses. The considerable change in the circulatory conditions of the tumor and the pronounced venous stasis is usually shown very decidedly, a few days after the operation, by the enlargement of the tumor and hemorrhage, both of which may be very notable. In one fatal case the tumor became very œdematous. As a rule, this swelling subsides, probably by the aid of collateral vessels. The serous infiltration of the vessels favors retrogressive metamorphosis, which often sets in very quickly. The disappearance of even large fibroids, which not infrequently occurs very rapidly, sometimes even in a few weeks, undoubtedly depends upon the circulatory disturbances. The artificial menopause plays a minor part, and assists recovery chiefly by the prevention of subsequent congestions. On the other hand it is very important in the slow and gradual diminution of the tumor. But the changes produced by the stasis are not always compensated in a favorable way. The veins and lymphatics may be partly obliterated. In other parts they remain dilated and the thrombi may break down. The tumor, which had first undergone atrophy and perhaps had not given rise to hemorrhages for months, again enlarges, after renewed hemorrhages. It becomes soft and contains smaller and larger cavities, filled with serous or sero-purulent fluid (fibro-cystic or lymphangiectatic tumor). Its connections with the remainder of the organ become loosened, so that, if it had originally been more markedly developed towards the uterine cavity, a sort of spontaneous enucleation may begin. Thus, Fehling removed per vaginam a fibro-myoma which had extended to the umbilicus, and in which I had performed castration about 3 months previously. At the time no hemorrhages occurred but they began later. Pains set in, the cervix shortened and the os dilated. Bantock extirpated, about 2 years after castration, a myoma which had undergone cystic degeneration and which, after the former operation, had first diminished in size.

The causes of this rare termination are not thoroughly known. In my two cases the tumors developed from the lower half of the body of the uterus, and had grown between the ligaments; one of the tumors was enormous in size. Bantock's case was that of a small fibro-myoma which developed in the ordinary way. The termination has been attributed to the irritation of the silk ligatures or the remains of the ovaries (Thornton). Tait claims that neither the removal of the ovaries nor the ligature of the vessels plays any part in the cure of fibro-myomata. The real causal factor is the extirpation of the tubes, because the latter, not the ovaries, provoke menstruation. We think it is unnecessary to combat this theory, and will merely remark that in a large number of castrations, performed in fibro-myomata, the ovaries were removed without the tubes, without impairing the results. The fact that Tait observed amenorrhœa and shrinking of the myoma in a case in which he was unable to remove the ovaries, and therefore merely stripped the tubes from the tumor and ligated their uterine extremities, does not prove anything. Some tumors of this kind possess little resistance, and undergo atrophy after moderate diminution of the blood supply and disturbance of the circulation. The tubes are dependent on the ovaries as an excretory duct on its gland. They are rudimentary or absent when the ovaries are in a similar condition. They do not grow or even become smaller if animals are castrated when young. Finally, atrophy of the tubes has also been observed after castration of adult women. On the other hand the first development of the ovaries, their growth and subsequent condition, are entirely independent of the tubes.

As a general thing fibro-myomata require operative interference only when they grow rapidly and produce violent hemorrhages, or produce dangerous or very distressing symptoms by compression, displacement of the viscera, etc. As soon as surgical treatment is indicated, castration must be compared with other operations, such as enucleation through the vagina or abdominal walls, supra-vaginal amputation of the uterus, removal of the pedicle when the tumor is subserous and pedunculated, and even total extirpation of the uterus.

The choice of one or the other operation depends on the size, structure, connections and situation of the tumor. Enormous tumors require extirpation and would justify castration only when the radical operation appears too dangerous on account of the structure and connections of the tumor or the general condition of the patient, while the ovaries may be easily removed without any risk. This is also true of all fibro-cystic tumors, even if small. But we would not entirely exclude castration, inasmuch as a good result has been reported even in this form (Thornton, *Lond. Obst. Soc.* Vol. XXIV. p. 137). In submucous fibroids, which project strongly towards the uterine cavity, removal through the natural passages can only be recommended if there is beginning spontaneous enucleation and a favorable preparation of the cervix. The enucleation of a tumor in the cervix or lower segment of the uterus, after incision of the fornix vagina, need be taken into consideration even less frequently. Sub-serous tumors are usually pedunculated. In other cases a sort of pedicle may be formed, or, at least, removal is possible without opening the uterine cavity. Extirpation of such tumors is also indicated, as soon as they have produced injurious effects by their size, mobility, impaction in the pelvis, irritation of the peritoneum. But as these growths are rarely isolated, as the entire uterus is almost always affected, and other nodules are apt to develop further, we think that castration is also indicated at the same time if unattended with any considerable danger. Castration has been excluded in myomata of the cervix, and laparotomy has been performed, unless enucleation through the natural passages was possible. It was supposed that castration would be less effective in such tumors because they are supplied by the uterine artery. In some cases, furthermore, the symptoms of pressure and impaction apparently necessitated speedy removal of the tumor. We have performed castration three times in large tumors of this kind. In one the success was complete. The hemorrhages and menses ceased and the tumor shrivelled. In the second patient the hemorrhage ceased and amenorrhœa set in, but the tumor continued to grow. The third case is too recent. At all events the one favorable termination should stimulate further attempts, especially because castration is usually very easy and devoid of danger because the uterus is pushed upwards. If the operation is unsuccessful, extirpation of the tumor still remains. Hence, we prefer castration to the very dangerous extirpation of the tumor by laparotomy.

With the exceptions mentioned castration should first be performed in all fibro-myomata, which require operative interference, and it is especially preferable to supra-vaginal amputation of the uterus. The results of the latter operation, combined with intra-peritoneal treatment of the stump, are decidedly bad. The results of extra-peritoneal treatment of the pedicle are much better, but the mortality is nevertheless greater than after castration. We must therefore take the more favorable chance, even if, as happens in rare cases, it must be followed later by extirpation. In exceptional cases (very low ovaries, firm adhesions, marked varicose dilatation of the ovarian veins), castration may be more dangerous than removal of the body of the uterus.

Supra-vaginal amputation of the uterus has often been preferred to castration because the former is a more rational and radical method. But this means very little. We need not wish to attain more than the cessation of hemorrhage and atrophy of the tumor, and the slighter the danger in attaining these objects the better.

6. *Chronic inflammations of the tubes, pelvic peritoneum and parametrium.*—The diseases of these structures, and the coincident affections of the other sexual organs, bladder and rectum (which occur partly as complications, partly stand in causal connection with these inflammations), are extremely manifold: thickening and retractions of the sacro-uterine and broad ligaments, broad adhesions, membranous and band-shaped adhesions between the pelvic organs, or between these and the intestines; in recent processes, collections of serous fluid, gelatinous masses or metamorphosed extravasations of blood.

In addition, changes in the shape and position of the uterus, immobility of the uterus, thickenings on its surface, circumscribed or diffuse hyperplasia of the connective tissue or muscular coat, endometritis of the body or cervix with erosions.

Also, small cyst follicular degeneration and degeneration of the ovarian stroma, with more or less disappearance of the glandular tissue, thickening of the albuginea, displacement of the organ and adhesions to the wall of the pelvis, uterus, etc.

Also, occlusion of the extremity of the tube usually with adhesion to the ovary, pelvic walls, uterus or other parts, such as the floor of Douglas's *cul-de-sac;* hydrosalpinx, small tubo-ovarian tumors, or distension of the tube with thick cheesy masses.

Other structures are often affected. For example, we find small parovarian cysts, small papillary or cystic formations on the serous covering of the tubes and vicinity, small fibrous nodules, especially on the fimbriæ, occasionally calcified and laminated. Fibromata as large as a bean or even a walnut may also be found.

The chronic inflammatory process often starts from an infectious catarrh of the tubes; sometimes primarily in the ovary, a great part being then played by abnormal development and retrogression of the follicles in consequence of venous congestion and sexual excitement. In other cases uterine displacements give rise to irritative, inflammatory processes as the result of flexion and compression of the vessels. In puerperal, gonorrhœal or other infections, such as are found in chronic catarrh and erosions of the portio vaginalis, the process travels very often through the walls of the vagina and uterus or through the cellular tissue to the peritoneum. Compared with the changes in the ovaries and tubes, the parametritis and peritonitis must then be regarded as primary. In rare cases the pelvic peritonitis starts from an affection of the bladder, rectum or even one of the abdominal viscera.

The genesis of the symptoms is extremely varied and often complicated. The vessels and nerves imbedded in an infiltrated, hard or shrunken tissue are compressed or bent, and venous stasis and nervous symptoms are thus produced. The circulatory disturbances give rise to various secretory anomalies of the uterus, disorders of menstruation, swelling and catarrh of the mucous membrane. When the uterus is imbedded in a firm exudation, its fixation and the changes in its shape and position cause further anomalies of function. The normal activity of the ovaries may also suffer from thickening of the albuginea, and from the displacement produced by the surrounding firm tissues or pelvic peritonitis. The adhesions of the bladder to surrounding parts or its situation in exudation may render any considerable fullness of the organ impossible in a mechanical way or produce abnormal conditions of pressure, and thus dysuria and ischuria. The walls of the rectum are sometimes incapable of normal contraction. Even the ureters and kidneys may suffer, the former on account of traction and flexion. We must not forget to mention that the mesentery of the colon, sigmoid flexure and small intestines may be adherent to the pelvic organs, and give rise to digestive disturbances, intestinal catarrh, irregular peristalsis, and constipation.

The various sources of the numerous symptoms must make us extremely careful in formulating the indication. We refer the reader to the general remarks on the curative effects of castration. Success is to be expected in those cases particularly in which the operation removes the factor which gave rise to the symptoms. In some cases the latter are confined chiefly or exclusively to the menstrual period, or, at least, are re-excited by the menses. The anatomical change *per se* would not give rise to any symptoms, since these require a second factor, *viz.*, the menstrual congestion. But this condition of things is rarely so pronounced that it alone warrants the operation. The indication is better founded when the disturbance of ovarian activity, produced by the disease, gives rise to the symptoms, as happens so frequently in displacement and compression of the organ in the inflamed tissues. The indication is also more assured when the symptoms are partly produced by fixation of the uterus, especially in an abnormal shape and position, by bands or false membranes, or by similar conditions of the bladder, and are removed by castration.

The least is to be expected when the symptoms are produced solely by the structural changes of the connective tissue and their effects on the nerves and vessels, as is particularly true of atrophic parametritis.

As a general thing not much can be hoped for in wide-spread, intense and very old inflammatory processes. The factors which then concur in the genesis of the symptoms are usually numerous, and cannot be removed entirely by the operation. At the same time the danger of the operation is often very much increased.

Appendix.—An indication which is not based on anatomical changes in the sexual organs, does not appear to us to be tenable in the present state of our knowledge. Battey[1] cautiously formulated an indication of this kind, and unfortunately this has led to many unjustifiable operations. The following are the reasons adduced in support of such a procedure:

Some, for example Schrœder (*Verhandl. d. Berl. Ges. f. Geb. u. Gynaek. Sitzg.* Feb. 9, 1883), say that changes in the sexual organs, especially the ovaries, may be present and give rise to the symptoms, although they cannot be recognized on examination. It must be conceded that this is possible. But on such possibilities we cannot found a positive judgment on the genesis of the symptoms, and still less can the indication for a dangerous operation be based on this possibility. A mere symptom-complex, a series of functional disturbances of the sexual organs[1] or nervous symptoms, which often appear in remote parts of the body, do not permit a positive opinion concerning their origin. This is also true of many other organs. If we do not abide by the demonstration of the anatomical changes, we lose our solid foundation, and then operations which are analogous to castration of the healthy testicle for neuralgia of that organ, become unavoidable.

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[1] "In cases of long protracted physical and mental sufferings, dependent upon monthly nervous and vascular perturbations, which have resisted persistently all other means of cure, the question of a resort to the operation is to be committed to the prudent judgment of the conscientious practitioner in each particular case."

Others have expressed the view that, in the development of a clinical symptom-complex, the physiological function of the normal genital apparatus forms one factor; the general disposition, especially the abnormal condition of the nervous system, forms the second causal factor. Both factors possess equal significance. It was even said with regard to certain cases that the sexual function is too much for individuals of certain bodily constitution, while they are healthy without this function.

Views of this kind are entertained particularly with regard to diseases whose symptoms explode exclusively or chiefly during the menstrual period—for example, the periodical psychoses. The results obtained by castration under such circumstances were not very favorable. It seems that the normal function of the sexual organs has a not unimportant significance as an occasional factor, but that the main cause of the disease is situated in another locality. And it is especially important that the occasional factor, after its removal, may be readily replaced by another. On closer examination, furthermore, it is often found that the symptoms do appear more severely during menstruation, but that the patients are by no means healthy during the intervals. This is particularly true, for example, of mental affections and severe neuroses, in which an hereditary taint is often demonstrable. Menstruation is, therefore, not a coördinate factor in the genesis of the disease, and, after its cessation, some other exciting cause takes its place. Furthermore, it should always be borne in mind that menstruation is not such a simple process as has been hitherto assumed, under the influence of the exclusive ovulation theory or even of Pflueger's hypothesis. At all events various factors are present during menstruation, such as increased or diminished blood pressure, the irritation of the swollen follicle, the swelling of the uterine mucous membrane, and the variations in the bodily temperature. These may act as exciting causes, either singly or in combination, and it is evident that some of these factors may develop in consequence of other influences.

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[1] We should even be more cautious in the interpretation of menorrhagias, uterine hemorrhages, disturbances of the menstrual rhythm, dysmenorrhœa, and even of secretory anomalies of other kinds. All these symptoms are generally attributed to primary affections of the genital apparatus, but this is by no means always justifiable. Numerous physiological and pathological investigations have shown that the symptoms may have entirely different sources.

The curetting of the mucous membrane, which is now employed so generally in uterine hemorrhages, appears as rational as if the nasal mucous membrane were curetted at each epistaxis, or was manipulated forthwith with tincture of iodine and astringents.

Finally, the indication for castration has been based on its general effect on the entire organism, and particularly on the nervous system. But unfortunately these effects are not sufficiently known. We know that castrated animals exhibit a tendency to the accumulation of fat and that they become more docile. We know of cures of serious neuroses during or after the menopause, but also of the development and exacerbation of such affections. We assume its favorable influence on osteomalacia—an influence which does not depend solely on the non-occurrence of pregnancy.

Hence we are not justified in formulating an indication when pathological changes of the sexual organs are not present. Either we must have to deal with the removal of a focus of irritation, such as the diseased ovary, and at the same time of surrounding parts, or we make use of the well-established influence of extirpation of the ovaries, *i.e.*, the abolition of the ovarian functions, upon the other sexual organs. Perhaps in the future we will discover other well-founded indications, but in the present state of our knowledge this does not appear possible.

TECHNIQUE OF THE OPERATION.

The preliminaries are similar to those of ovariotomy. Concerning the antiseptic measures, see page 174.

The most suitable period for the operation is the first week after the cessation of menstruation, but it may also be performed as late as 4 to 5 days before the expected menstrual period. In very anæmic individuals, especially those suffering from fibromata, and considerable menorrhagia, it is even better to wait until they have recovered sufficiently from the previous menstruation, and to operate shortly before the next period. A stasis hemorrhage will occur in all cases, and otherwise it would occur too soon after the menstrual hemorrhage.

The position of the patient depends on the method of incision, but also on the supposed difficulty of the operation and particularly upon the connections of the ovary. If abdominal incision is chosen a long, not too broad, four-cornered table is selected. The trunk is moderately elevated, and the lower limbs somewhat flexed at the knees by the aid of pillows, so that the abdominal muscles are relaxed. A very good operating table is that of Pean. When this is used the introitus remains free so that, if necessary, the introduced hand of a special assistant may be employed for elevating the uterus and its appendages.

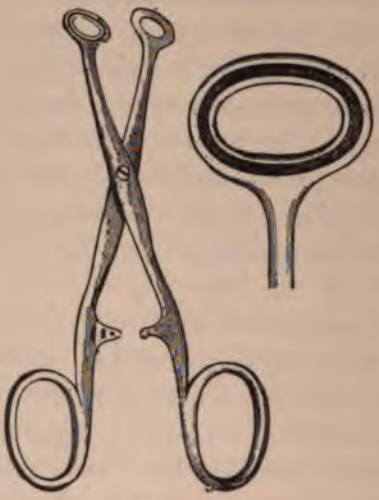

FIG. 128.

In difficult cases, especially if the ovary is firmly fixed and situated low, if the uterus and appendages are moved with difficulty, the patient is advantageously placed as in Freund's operation, or the preliminaries are arranged in such a way that this position may be rapidly assumed, even if we suppose *a priori* that it may be dispensed with.

If we decide on vaginal incision, Sims's or Simon's or the ordinary lithotomy position may be selected. But the lateral-abdominal position is changed after the peritoneum has been opened.

An assistant at the head of the patient administers the anæsthetic, a second one, at the side of the table, assists the operator, a third hands the instruments. A nurse attends to the sponges.

The instrumentarium consists of a broad-bladed bistoury, a blunt-tipped bistoury, curved scissors, ordinary straight scissors, a hollow sound, forceps, clamp-forceps, ovarian forceps, Dechamp's needles, silk ligatures of various sizes, catgut, elastic ligatures, catheters, large and small sponges and sponge-holders, abdominal bandage and dressing.

The ovarian forceps (Fig. 128) has, at its tips, oval rings with fenestræ, whose ribs are carefully rounded externally. When both rings are closed the blades are somewhat separated as far as the lock, in order that the viscera may not be caught between them. The lock permits perfectly tight or less firm closure of both rings, so that the ovary, when grasped, may not be pinched off.

The operation consists of three stages, first the opening of the abdominal cavity, secondly the search for the ovary, and thirdly, the toilette, closure of the wound, and bandaging the abdomen.

FIRST STAGE.—OPENING THE ABDOMINAL CAVITY.

Various points for opening the abdominal cavity have been selected, for example, the linea alba, the iliac region above the lateral part of Poupart's ligament, or some other part of the abdominal wall, varying according to the special position of the displaced ovary, and finally the posterior fornix of the vagina.

The incision through the linea alba possesses the great advantage that, if necessary, it may be elongated as much as possible. If the linea alba is not included in the incision or only in part, the muscular fibres may be cut longitudinally. If a good deal of room is needed in some special case, this may be secured, if necessary, by making lateral incisions in the recti.

When normally situated it is not difficult to draw the ovary into the median line and even in front of the abdominal walls. But very considerable resistance may be offered by a rigid infundibulo-pelvic ligament, firm pathological adhesions to the lateral wall of the pelvis, pronounced rigidity of the entire broad ligament, deep position of the ovary in the pelvis and Douglas's sac, and adhesion to these parts. In cases of fibroma the ovaries are situated not infrequently entirely to the side and occasionally more posteriorly. The tumor may be very slightly movable, cannot be pushed to one side, and still less can it be turned on its long axis, so that the ovaries are brought into the median line with extreme difficulty or not at all. After the operation the pressure of the usually enlarging tumor, especially if tympanites is also present, may stretch the sutured abdominal incision, and may even cause it to burst open. This danger is greater when the incisions are long.

The *flank incision* is commonly adopted by the veterinary surgeons, but Hegar is the only one who has used it in women. It has the advantage of making a shorter path to the ovaries. But this is only serviceable when the ovary is fixed more firmly than usual to the side of the pelvis. Its disadvantages are that a double incision must be made, more vascular tissues are cut, and the muscular fibres are more apt to be cut obliquely. Nor can the incision be made as long as may be desired. The muscular fibres, which are cut obliquely and transversely, retract forcibly so that the cicatrix is often thin. If the ovaries are situated closer to the median line, if the ovarian ligament is short or there is an abnormal connection with the uterus, or if the latter is fixed so that it cannot be shoved sufficiently to one side, very considerable difficulties may ensue. Incisions in other parts of the abdominal walls are attended with similar disadvantages.

The advocates of *vaginal incisions* claim that the secretion of the wound escapes readily, and that, if necessary, a drainage tube may be inserted through the open incision. In addition, the fingers or instruments come very little or not at all in contact with the viscera, particularly the intestines. But the disadvantages of the method are by no means slight. It is sometimes difficult to make the incision, particularly the opening into the peritoneum. Douglas's sac sometimes does not descend very far, and, in fibromata, the peritoneum may even be elevated. The adhesion of the peritoneum over the fornix is not very firm, and sometimes a thick layer of loose connective tissue is inserted between the vagina and peritoneum, and must be incised before the latter is reached. A canal whose tissues are readily infiltrated is thus produced. Under normal conditions the tension of the ligaments prevents any considerable traction of the organs downwards. The pedicle must be treated and the ovary removed without the complete aid of the sense of sight. Sufficient exposure is impossible in case of accident, such as hemorrhages or firm adhesions.

The incision through the *linea alba* is made in the same way as in other laparotomies, but it presents certain peculiarities. The abdominal walls are not stretched and thinned, as in large tumors, the subcutaneous cellulo-fatty tissue is more abundant, the recti are in closer apposition, so that the linea alba is recognized with greater difficulty. The subperitoneal adipose tissue is often quite thick. The peritoneum is usually unchanged. The blood-vessels of the abdominal walls are more abundant. The distance between the umbilicus and symphysis is not enlarged and hence a long incision—for example, one which is required for the passage of the entire hand—may occupy this entire distance or even more.

In operations which promise to be mild, we make an incision about 8 to 10 cm. long, beginning 2 to 3 cm. about the symphysis. After the cutis and subcutaneous tissue have been rapidly incised, spirting vessels are carefully ligatured. We then search for the linea alba and incise it. If we miss it and come in contact with the muscle, at some distance from the median line, its edge is drawn to the side with the tips of the fingers. If the adipose tissue is not very thick, it may be cut through layer by layer. If it projects in large ridges, it is partly excised. Whatever hemorrhage may take place is then checked. The peritoneum must be incised with great care. Thin folds are raised with a fine pair of forceps and are cut off flat. A grooved director, introduced into the opening, will inform us in doubtful cases. The movement of the instrument is prevented if the peritoneal cavity has not been entered. After a small opening in the peritoneum has been made the director is introduced, then the index finger, and the incision is prolonged with a blunt-tipped bistoury or curved scissors. Even this must be done very cautiously. The omentum and intestines are often so close to the finger that they may be wounded. Each incision must be carefully watched and not made too long.

When the peritoneal cavity has been opened and the operation promises to be difficult, the peritoneum should be stitched to the wound in order that it may not be separated too extensively from the abdominal walls during the subsequent manipulations. A suture in the lower angle of the wound is usually sufficient.

In complicated operations, for example, when there are firm adhesions, it is best to make the incision larger from the start. It may extend quite close to the symphysis if injury to the bladder is prevented by the aid of the introduction of a catheter. Superiorly the incision must be extended to or even above the umbilicus. Even the recti may be nicked from the start (the peritoneum must be spared by these incisions) if, for example, the abdominal walls are very tense, as in nullipara, and small broad-based tumors or firmly adherent and deep ovaries promise to render necessary the exposure of the lower part of the pelvis. If Freund's position is adopted, longer incisions will be required.

The position in *incision in the flank* is the same as in incision through the linea alba. To avoid the epigastric artery, we measure a point on the linea alba 3 to 4 cm. above the symphysis, and then 5 cm. to the side. If the incision starts from the latter point, the artery will be avoided under normal conditions (in this region the vessel is about 4 cm. distant from the linea alba). The incision passes a little above Poupart's ligament towards the anterior superior spine of the ilium, and may be extended to a length of 6 cm. The skin is divided, then the cellulo-fatty tissue, during which one or another small artery usually must be ligated, and then the aponeurosis of the external oblique is reached. This is incised, and then the fibres of the internal oblique and later the transverse muscle. It is well to gain more room, if possible, by drawing the muscles apart. We next come in contact with the præ-peritoneal tissue, and can usually detect any larger vessel running through it. This receives a double ligature before being cut through. It is possible that the epigastric may be situated more to the outside than usual, especially in cases of fibromata, which push forward and stretch the middle portions of the abdominal walls. The hemorrhage must be carefully checked in all cases before cutting through the præ-peritoneal tissue and opening the peritoneum. Finally, the peritoneum is raised with forceps, opened, and the incision enlarged with a blunt-pointed bistoury or curved scissors.

Incisions in other parts of the abdominal walls are made in a similar manner, the greatest attention being paid to the course of the muscular fibres and the vessels.

In making the *vaginal incision* Battey first places the patient in the latero-abdominal position and then introduces a short duckbill speculum in order to push back the intestine. Others recommend dorsal decubitus from the start. The portio vaginalis is grasped with a pair of forceps, and drawn down below the symphysis. The incision (about 4 cm. long) is made with a pair of scissors in the median line of the posterior fornix. The peritoneum is not opened until the hemorrhage has been checked.

As a general thing the incision in the linea alba is the most advantageous. Incisions in other parts of the abdominal walls should only be made when the ovaries can be felt immediately beneath the parts in question. Lateral incisions are made with greater justification when a fibroma pushes the median part of the abdominal wall very strongly forwards.

Vaginal incision should be adopted only when the ovaries are situated very low and can be felt immediately behind the posterior fornix, so that we can cut almost directly upon them. Small tumors may push the posterior vaginal wall far downwards, and even give rise to ulceration. Such tumors have been observed even in prolapse of the posterior vaginal wall, and have been successfully removed by means of vaginal incision.

SECOND STAGE.—SEARCH FOR, GRASPING, AND WITHDRAWAL OF THE OVARY.—TREATMENT OF THE PEDICLE.

This stage may vary extremely. We will first describe it under simple conditions.

If an incision has been made in the linea alba, the hand is introduced into the abdominal cavity and first pushes along the anterior abdominal wall towards the pelvis. At the same time an attempt is made to push the omentum and intestines upwards. These structures may often be pushed up by introducing a sponge. This is particularly to be recommended if the omentum is long and extends downwards. In one case we were compelled, after applying a double ligature, to cut through the omentum which was firmly adherent to the uterus and base of the bladder, and prevented further entrance of the hand. After passing below the superior strait of the pelvis, the tips of the fingers are directed more posteriorly and endeavor to reach the fundus of the uterus. Along this they are passed laterally towards the ovary. This is encircled by the tips of the finger and drawn towards the wound. The organ is thus brought before the abdominal wound, and, in the majority of cases, a portion of the tube also makes its appearance. If loops of intestine or omentum also protrude, they are pushed back with a sponge. When the ovary is thus brought in front of the abdomen, the operator grasps it firmly with two fingers, while the assistant pushes together the abdominal walls on both sides. The ovary is then transferred to the care of the assistants, who hold it with the fingers or a pair of forceps.

The treatment of the pedicle depends upon whether the mesentery proper of the ovary alone can be employed as the pedicle, or whether a part of the tube is also to be removed. Even under otherwise simple conditions the mesentery of the ovary is not infrequently too short, and the pedicle will be too small. There is danger of leaving behind a portion of functionating tissue. A part of the tube and a somewhat larger portion of the broad ligament must then be removed. Furthermore, the mode of treatment varies; Battey used an écraseur. Other operators have always used the ligature with disinfected silk or catgut. If the pedicle or ligament is long and extensible, a single ligature *en masse* will suffice. If the retraction promises to be more considerable, a double ligature is introduced by means of a thin Déchamp needle (avoiding the larger vessels) and is tied on both sides. Blood escapes not infrequently from the suture canals. When the sutures are tied in different directions the tissues, and particularly the peritoneum at the point of ligature, may be somewhat separated and scraped off. A ligature *en masse* must then be applied below the double ligature. Moderately thick silk will suffice. It should be drawn very tightly, especially if the tube is included. The latter contains a larger artery, and has a tendency to slip back out of the ligature.

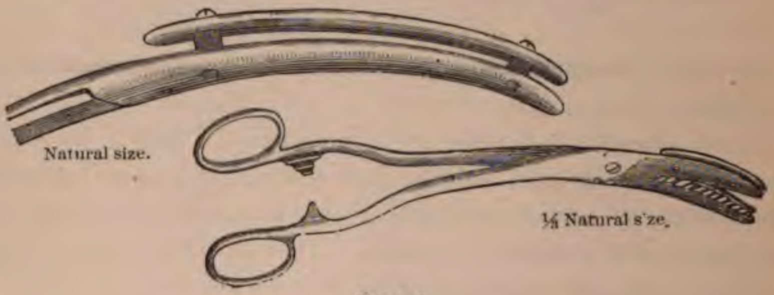

FIG. 129.

After treating the pedicle it may simply be cut off, and this materially shortens the operation. Formerly we resorted a good deal to the use of a small cautery clamp (Fig. 129) in order to destroy completely any portion of ovarian tissue which might remain. Inasmuch as Mueller has shown that this may undergo pathological changes and even cystic degeneration, it is best to cauterize it under such conditions. The compression and heat will almost always destroy the ovulating tissue which remains in the pedicle. But this procedure cannot be recommended as a general method. The operation will last 10 to 15 minutes longer, since the cautery must be applied twice.

After the pedicle has been separated it should always be inspected, particularly in order to determine whether other parts, such as a band of the omentum, an adhesion or an appendix epiploicus has not been included.

When the uterus is retroverted or retroflexed, some operators recommend a modification of the treatment of the pedicle, which will permanently relieve the displacement. They have included the pedicle in the abdominal suture, or have stitched it deep in the abdominal wound by a special suture. It is better to fasten it merely to the parietal layer of the peritoneum. Stahl sewed it into the abdominal wall by a sort of mattrass suture. The result was partly favorable, but permanent reposition was partly unsuccessful, undoubtedly on account of the stretching of the adhesions which had been formed. In double castration this modification seems to us to be unnecessary, inasmuch as the broad ligaments often are very much shortened, especially if the tubes have been removed in great part. A retroverted uterus will then become vertical, and, as we have convinced ourselves, may remain in this position. Even if this does not happen, the retrogressive involution of the organ renders the retroversion innocuous. Correction of displacements is proper in unilateral castration. The above procedures are therefore to be recommended, when practicable, but they may be rendered impossible and even dangerous by rigidity of the ligaments.

In incision into the flank the method is similar to that in incision into the linea alba.

In vaginal incision the patient should be placed on the back, after the incision has been made, in order to prevent the entrance of air. The hand applied externally then pushes the uterus downwards, and the index finger of the other hand is passed through the incision into the abdominal cavity. The finger is curved like a hook, grasps the ovary and draws it into the vagina, where the treatment of the pedicle is carried out.

Difficulties and accidents are quite frequent during the second stage of the operation. As a general thing, free exposure of the field of operation is extremely serviceable and often absolutely necessary under such circumstances; the incision should be enlarged, and even the recti may be nicked. If the omentum and intestines are very much in the way, the head and shoulders are kept low, as in Freund's operation, eventration performed if necessary, and the patient's head turned towards the window by turning the table.

The search for the ovary may be made difficult by its deep, concealed position, and by the constant interposition of loops of intestines. We are then aided by the assistant's hand, which, being introduced into the vagina, pushes up the entire floor of the pelvis, the uterus, and particularly the broad ligament. The finding of the ovary is also facilitated by tamponing the rectum or vagina, as recommended by Albert. But this seems to us less desirable inasmuch as we cannot modify the degree and direction of the pressure.

The ovary is not apt to be mistaken for other parts, but an appendix epiploicus, a part of the intestine or a lump of fæces in the latter, may lead us astray, if the palpation is made carelessly. A small pedunculated fibroma is more apt to be mistaken for an ovary. The former is recognized by its regular shape, more uniform surface, firmer and more uniform consistence, its situation, and the character of its uterine connections. However, not much harm will be done if such a tumor is withdrawn.

A resistance to the withdrawal of the ovary may be the result of non-pathological, firm, short connection of the organ, or of rigidity of the entire broad ligament. The resistance is generally overcome by slow, gradually increasing traction. If necessary, the assistant may push the part in question upwards by means of the fingers which have been inserted into the vagina.

The obstacles to the withdrawal of the ovary, resulting from pathological processes, vary in character. The ovary itself may be fixed by inflammatory processes, either in its ordinary position or in some unusual situation, for example, on the posterior wall of the uterus, at the floor of Douglas's sac, at the wall of the pelvis, even in the vesico-uterine fossa. Small tumors may even be situated between the folds of the ligament. The obstacle may also result from displacement of the uterus. For example, it may be situated deeply in Douglas's sac, and adherent so that even when the ovarian connections are normal, its resistance impedes the withdrawal of the ovary or even makes it impossible. Finally, the broad ligament is not infrequently thickened, retracted and unyielding on one or both sides, and thus offers considerable resistance. Combinations of these conditions are often met with.

The adhesions by means of which the ovary, situated in its normal or approximately normal position, is fixed to a greater or lesser extent, are often confined to its immediate vicinity. The organ adheres to the ligament or tube, or to adjacent parts of the uterus. But it may also be adherent to the intestines, appendices epiploicæ, omentum or mesentery, and these parts are then drawn towards the normally situated ovary. On the other hand, such adhesions may displace the organ to a greater or less extent. In rare cases its normal insertion is thus stretched and thinned, or even lost.

The adhesions are thread-shaped, band-shaped, or membranous. The organ, situated firmly on the ligament, is imbedded occasionally in extensive, rigid masses of exudation. When the adhesions are extensive the tube and broad ligament are usually affected to a marked degree. The tube is wound around the ovary or its mesentery, adherent to these parts and to the broad ligament, or the tube itself may be affected, provided with one or more cystoid dilatations, its funnel closed, and the fimbriæ situated on the ovary. The ligament is changed in structure, thickened, rigid and provided with small cysts (parovarium). When the organ is situated in an unusual position, remote from its original site, the adhesions are usually very extensive.

The firmness and vascularity of the adhesions vary. It is especially noteworthy that the ovarian vessels and the veins of adjacent parts of the ligament are sometimes unusually dilated and even varicose.

When small ovarian tumors are situated inter-ligamentary, the conditions may vary extremely. The connections are sometimes quite loose. The small tumor can be easily enucleated, without any extensive hemorrhage. In other cases the connections are firmer, and their separation require considerable force or even the use of the knife; the hemorrhage is considerable.

It is difficult to formulate definite rules for guidance under such varying conditions.

Even if the organ is firmly adherent, the parts to which it adheres may be so yielding and extensible that it may be drawn in front of the abdominal wound or at least be brought clearly into view. Steady, constant traction will stretch even resisting ligaments, without injurious consequences. If these favorable conditions are not present, if the resistance is considerable or if we fear that vigorous traction will produce rupture of vessels (as in varicosity of the vessels), greater exposure of the parts must be secured by prolongation of the incision, nicking of the recti, the assumption of Freund's position, and pushing back of the viscera. We must operate deep within the abdominal cavity. This will be necessary in almost all cases of intra-ligamentary development of small tumors.

Rupture of adhesions, which are not visible to the eye, we regard as justifiable only when they are not extensive, when they are thread-shaped or band-shaped, or when they are loose and can be removed without exercising much force.

If exposure has been secured in one way or another, the adhesions are separated in the same way as in ovariotomy. The conditions differ very little with regard to adhesions to the omentum, mesentery, intestines and appendices epiploicæ. Ligatures of vessels, larger or smaller ligatures *en masse* are often necessary, as they are in ovariotomy. Adhesions which are poor in vessels, require no ligature. Bands and threads, which pass from the ligament, tube and pelvic organs to the pelvic or abdominal walls, or which form bridges between these organs, must be separated, even if they do not offer any direct resistance to the removal of the ovary. Otherwise the change in the position of the intestines produced by the operation may give rise to incarceration. Hence the bands must be cut, if possible, at a short distance from their points of insertion, because a long piece may again become adherent in some locality and thus form a source of incarceration. Long, narrow shreds of omentum, which are found not infrequently, are ligated and cut for the same reason, even if the ends are not firmly adherent.

In extensive adhesions of the tube to the ovary two ways may be pursued. A ligature may be applied forthwith to the entire mass, the normal or dilated tube with the ovary. The site of ligature is then very extensive, as a general thing, and if the broad ligament is not yielding and flaccid, but, as is usually the case, is more or less rigid, so that the artificial pedicle cannot be compressed sufficiently, a single or even double ligature is not secure enough. In such cases numerous ligatures (3 to 6) must be applied. This guards against retraction of the pedicle and slipping of the ligatures. Moreover, another untoward factor obtains under such conditions, when the ligament is rigid. The point of perforation of the Déchamp needle, even if the latter is as round and narrow as possible, is drawn apart when the ligatures are tied, and hemorrhages result, though they are usually not very extensive. As a ligature *en masse* can not be applied with sufficient firmness when the ligament is rigid, these hemorrhages can only be checked by temporary compression.

When the adhesions are not too firm, especially when the tube is twisted around the ovary in a circle or semicircle, it is sometimes best to separate the adhesions first. We thus obtain a better view, need not apply the ligatures so deeply, may ligature individual bleeding places, obtain a better view of those parts in which there is marked retraction, and may treat more readily.

If the ligament is very rigid, we are sometimes unable to form even an imperfect pedicle. If we are unwilling to discontinue the operation, we must ligature a triangular piece of the ligament (with the apex downwards) and must cut out the intervening tissue with the ovary. If the elastic ligature, which is indispensable in such cases, is employed we will be able to compress even very firm, short and thick masses of tissue into a sort of pedicle. Even if there is a great tendency to retraction there is much less fear of slipping than when another material is employed.

In surface adhesions of the ovary to the uterus, pelvic walls or Douglas's sac, the separation may be effected by traction or enucleation. The use of the knife is sometimes required. The bleeding places are ligated. The portion of the uterus corresponding to the adhesions is often very vascular, and is apt to give rise to annoying hemorrhages or at least to constant trickling of blood. This occurs, for example, if the serous layer has been removed during the separation, and hence separation with the knife may be preferable to that with blunt instruments. Such hemorrhages are often checked with difficulty. It is best effected by means of acupressure, very narrow, round needles being inserted at quite a distance from the bleeding spots.

A similar plan must be adopted in firm adhesions to the pelvic walls or surface adhesions to Douglas's sac. Special caution is necessary when the ovary is adherent at the posterior portion of the linea terminalis near large vessels.

Sufficient exposure is always necessary under such difficult conditions, and working in the dark may be attended with very bad results.

In small intra-ligamentary tumors the conditions are very different. They may be enucleated occasionally without any great difficulty and without notable rupture of vessels. But great obstacles are generally encountered, and these become more serious the more the tumor has developed near the base of the ligament and the lateral wall of the pelvis. The small cysts rupture, the tumor loses its integral connection, strong adhesions must be torn. The hemorrhage may become considerable. Under such circumstances, which may often be diagnosed in advance, we consider the operation to be contra-indicated. But if we have made a mistake, the operation should be abandoned, if this is still possible. If this cannot be done, because the true condition was disclosed too late, the tumor must be entirely removed with blunt or sharp instruments, and its bleeding bed treated with ligatures and acupressure.

Unusually grave conditions and accidents are observed in cases of fibromata. One or the other ovary could not be found. We cannot recommend the withdrawal of the tumor from the abdominal cavity, as has been done in order to obviate this difficulty. Under such circumstances the tumor soon presents circulatory disturbances, intense redness or a bluish discoloration, sugillations, transudation of lymph. The tumor enlarges rapidly, so that it may be impossible to replace it within the abdomen without prolonging the incision. The danger of the operation is increased considerably. It is better to abandon the castration and to close the abdomen or to perform myotomy.

Even if the ovary has been found, considerable resistance to its withdrawal is often experienced in cases of fibroma. The organ is situated too far from the incision, to the side, posteriorly or inferiorly. Its mesentery is too short, so that the ovary is situated directly on the tumor or presents abnormal connections. The hand, which has been inserted into the vagina, attempts to push the tumor up and towards the side opposite to the ovary, if the incision has been made in the linea alba. If the flank incision has been made, it is pushed towards the side of the incision. We can sometimes help ourselves by rotating the tumor around its long axis. The more movable the tumor, the more readily may such manipulations be made. In these cases, also, we would advise against complete extrusion of the tumor. On the other hand, we recommend elongation of the incision, nicking of the recti, and, in cases of extreme necessity, even a more suitable incision in some other locality. The withdrawal of the ovary by forcible traction is to be particularly avoided in cases of fibroma, as they may be associated with dilatation of the veins, even bundles of varicose veins, which are apt to burst.

The treatment of the pedicle in fibromata is often very difficult on account of the not infrequent shortness of the mesentery of the ovary, or the complete unfolding of the mesentery and the adjacent parts of the ligament. In such broad-based insertions numerous ligatures must be applied. In the introduction of the needles larger vessels must be avoided. It may also be necessary to encircle the cut surface with a suture of fine silk. When the suture canals bleed, prolonged compression should be employed, if a ligature *en masse* cannot be applied on account of the large circumference of the insertion. The elastic ligature is very well adapted to many of these cases.

In one case, in which there were large varicosities of the ovary and surrounding parts, we were unable to check the hemorrhage which followed the introduction of the needles. It became necessary to perform supra-vaginal amputation of the uterus, which terminated successfully. We should adopt the rule to make all preparations for this operation when performing castration on account of fibromata.

Hemorrhages have been observed not infrequently after the second stage of the operation has been completed or nearly completed, whether the castration was performed on account of fibromata or some other morbid condition. Its sources are torn adhesions, which have not been properly treated, and the slipping of the ligatures of the pedicle. In the former event the hemorrhage may be moderate or even so slight that there is a good chance of its spontaneous cessation, particularly after the closure of the wound and the application of a somewhat firm abdominal bandage.

The slipping of the ligatures may be the result of various causes. It will hardly be necessary to warn against traction on a tied ligature, for the purpose of fixing the pedicle in the incision. We have referred previously to the mistake of applying a pair of forceps over the ligature itself while fastening the pedicle. If this is done some traction on the silk will be exercised on removing the instrument. Another cause is the insufficient tying of the knot. The ligatures should be drawn as firmly as possible. This is especially necessary in castration combined with salpingotomy, in which the pedicle is often unusually thick and composed of firm, slightly compressible tissue. Finally, it may be the result of the thickness and rigidity of the pedicle or ligament. This, having been forcibly stretched, subsequently retracts vigorously. The ligament really draws back out of the ligature. A certain degree of security is afforded by several ligatures, all of which are tied very firmly. The elastic ligature is the best safeguard. If such a disagreeable accident does happen, we must obtain sufficient exposure of the parts, introduce the fingers and withdraw the ligament, and again apply ligatures.

THIRD STAGE.—TOILETTE AND CLOSURE OF THE ABDOMINAL WOUND. —AFTER-TREATMENT.

In many cases the toilette may be terminated very rapidly. In simple castration there is nothing which will give rise to soiling of the abdominal cavity with blood or rapidly produced, considerable exudation. But we should not fail to convince ourselves, by the introduction of sponges, of the dryness of the peritoneal cavity. A follicle, a small cyst filled with blood or serum, bursts not infrequently when the ovary is removed. This does not amount to much. If the abdominal cavity previously contained exudation, it is allowed to escape; the discharge may be accelerated by pressure. Complete removal is unnecessary, as these transudations possess no noxious qualities. We have found small amounts of serous transudation very often in fibromata, peri-oophoritis and pyosalpinx, and larger quantities of sero-bloody fluid in granular peritonitis and tuberculosis of the tubes.

As a general thing the abdominal wound is closed in the same way as in ovariotomy. As the abdominal walls have not been stretched by a tumor, they are usually thicker, more vascular, and contain a thicker layer of adipose tissue. Since the incision is usually not very large, the edges of the wound are apt to be maltreated and the peritoneum separated from the abdominal walls. We unite the peritoneum separately, therefore, with a continuous catgut suture. Then follow 4 to 5 silk sutures, which include the abdominal walls and integument. We often place narrow strips of iodoform gauze between the sutures and extending nearly to the peritoneum, especially if the walls are very thick and fat, and the recti have been nicked. Then comes some iodoform or sublimate gauze, a layer of cotton, and finally a linen bandage.

The after-treatment differs very little from that of ovariotomy, and we refer the reader to the remarks on that subject.

Bloody discharges, evidently a symptom of stasis and a relief to the distended vessels, are ordinarily observed immediately after or some time after the operation. Considerable hemorrhages have been noticed by us only in cases of fibroma, but we have never been compelled to employ treatment. In extreme cases, a low position of the shoulders with elevated pelvis, ice-bags and hot irrigations may be employed.

Tetanus has not been observed hitherto after castration. Intestinal stenosis occurs in not a few cases. This may result from adhesion of a loop of intestine to the stump, the inclusion of an appendix epiploicus in the ligature, the formation of an adhesion between the abdominal walls and a tongue-shaped prolongation of the omentum, old adhesions which traverse the pelvis. These points should be considered in performing the operation. Prolongations of the omentum should be cut off, after being tied; in tying the ligatures, foreign structures should not be included; bands, which traverse the pelvis, must be torn or tied and then cut off. It seems to us that excessive compression of the abdomen, and perhaps prolonged constipation, may favor the production of ileus. If this condition has developed, we should try change of position, especially oblique decubitus with very elevated pelvis, intestinal irrigations of water, or distension with gas (effervescent mixtures, etc.). The last resort will be the reopening of the abdominal cavity. In two cases we have operated successfully after laparotomies. The ileus had resulted from adhesions of the loops of intestines to the anterior abdominal wall or the stump of the pedicle.

The most frequent sequel is circumscribed peritonitis. This generally begins with fever and pain soon after the operation, but not infrequently at a later period, so that the elevation of temperature does not appear until the tenth to eighteenth day. Its course is often very slow. The exudations may be very extensive, but we usually find smaller nodules, from the size of a pigeon's egg to that of an orange, of a hard or elastic consistence, and almost always in a position which corresponds to that of the pedicle. Simple callous thickenings of the ligaments, tense threads and bands, which unite the various pelvic organs to one another and to the pelvis, are also observed. The nodules often remain stationary after the first grave symptoms have run their course, and then give rise, though not always, to disagreeable symptoms of irritation. They give rise particularly to nervous symptoms and to constant or periodical congestions, even to irregular or periodical hemorrhages. Abscesses have also been observed soon after the operation. They may also develop long afterwards. even after the lapse of years.

There are numerous causes of such an inflammation. Occasionally it may be an exacerbation of a previously existing process. The predisposition is increased by the often large, rigid pedicle, and the almost always bilateral extirpation. The infection sometimes starts from the mucous membrane of the tube, which is not infrequently diseased. The ligature may also be at fault. Silk ligatures appear to be particularly injurious. Even if they are aseptic at the start, they are more apt, on account of their physical structure, to absorb noxious substances than other ligatures. In one case Mueller observed cystic degeneration and an inflammatory process, which started from a portion of the ovary that had been left behind. The retention of a diseased tube has also been regarded as a cause.

The treatment is similar to that of every other circumscribed peritonitis. Some observers have seen unilateral or bilateral parotitis, attended with moderate fever, after castration (Zweifel, Goodell.)

MORTALITY AND MORBIDITY.—PHYSIOLOGICAL RESULTS.—RESULTS WITH REGARD TO THE RELIEF OF PATHOLOGICAL CONDITIONS.—CAUSES OF FAILURE.

On account of the great difference in the anatomical changes, general statistics have only a limited value. Nevertheless we will furnish a *resumé* of all the castrations performed by Hegar until the end of August, 1885. These do not include any exploratory incisions or incomplete operations. The results lately have improved considerably, for example, there was no fatal result in the last 21 castrations and salpingotomies.

132 *Castrations:*
- 18 small tumors.
- 12 small cyst and follicular degeneration and degeneration of the stroma.
- 55 fibromyomata.
- 25 other morbid conditions of the uterus.
- 22 pelvic peritonitis, inflammatory changes in the ligaments.

Mortality and Morbidity.

Fatal results 16=12.1 per cent.
Complications 30=22.7 per cent.
Undisturbed course 86=65.2 per cent.

Death resulted:
- 12 times from septic disease.
- 1 time from small contracted kidney, which had been overlooked.
- 3 times from intestinal occlusion.

The following were the complications:
- 18 symptoms of circumscribed peritonitis; exudations; abscesses.
- 6 thrombosis of the thigh.
- 3 cystitis.
- 1 pneumonia.
- 1 ileus, from adhesion of the small intestines to the pedicle; relieved by laparotomy 5 days after the first operation.
- 1 corrosive sublimate poisoning.

Tait furnishes the following summary, which unfortunately gives no information concerning the exploratory incisions and incomplete operations:

245 *Operations:*
- 99 myomata.
- 139 inflammatory processes.
- 6 epilepsy.
- 1 deformity.

Fatal cases 17=7 per cent.

Very excellent results in smaller series of cases, have been obtained by Kaltenbach, P. Mueller, (21 cases with 1 fatal termination), Fehling (12 cases, none fatal), Tauffer (17 successful cases), Fritsch (11 cases, 2 deaths.)

In general, therefore, the prognosis is favorable, especially when we remember that the operation is still new, and that experience must be dearly bought.

The statistical tables which refer to the pathological conditions, are more important, although we are unable to avoid certain arbitrary opinions. The changes are usually manifold, so that the terminology would be vague, unless these combinations are converted into special classes. The following tables refer chiefly to Hegar's operations. Those of other writers are in part too scanty, in part they are not arranged according to the same principles, or they are described very imperfectly.

I. SMALL TUMORS.

Hegar: Mortality and Morbidity.

18 *Operations:*

2 deaths =11 per cent.

6 complications=33 per cent. 4, circumscribed peritonitis, exudation and abscess. 1 thrombosis, 1 corrosive sublimate poisoning.

10 undisturbed course=56 per cent.

Bloody Discharges:

No notes concerning 5 cases, 1 still too recent.

Remain 10:

7 menopause.

1 at first menopause, later bloody discharges.

2 persistence of regular or irregular hemorrhages.

Final Results:

No notes concerning 5, or they are too recent.

Remain 11:

10 complete or almost complete recoveries (1 molimina, 2 severe congestions, 2 abdominal pains occasionally.)

1 incomplete recovery. Relief of local symptoms, persistence of nervous disturbances.

II. SMALL CYST FOLLICLE DEGENERATION AND DEGENERATION OF THE STROMA.

Hegar: Mortality and Morbidity.

12 *Operations:*

2 deaths=16.6 per cent.

2 complications=16.6 per cent. Cystitis; exudation.

8 undisturbed course=66.8 per cent.

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[1] Only those cases are included in which the disease was not much complicated. At the most, no attention was paid to moderate uterine displacements or a slight peri-oophoritis. A strict selection seems necessary on account of the obscurity concerning the sequelæ of the affection.

Hemorrhages:

No notes concerning 2; 3 still too recent.

Remain 5:

4 menopause.

1 persistence of hemorrhage.

Final Results:

No notes concerning 1, 3 still too recent.

Remain 6:

3 complete recoveries.

2 occasional pains in abdomen.

1 unsuccessful. Violent neuralgia continues.

The unsuccessful result occurred in a patient whose uterus was slightly retroflexed. The right ovary was situated low down and considerably swollen. The left ovary was in a similar condition, but to a less marked extent. At the operation the right ovary was found slightly adherent, and the violent pains took their origin particularly in this ovary. The result was unfavorable. The pains returned, from what cause we do not know. We must still regard the operation as justifiable. The 3 cases of recovery have been under observation for several years. Very good results in individual cases have been obtained by Bircher, Tauffer, Menzel and Kaltenbach.

III. Uterine Conditions, which prevent the Secretion or Excretion of the Menses.

We have had no experience in cases belonging to this category, and few have been reported.

Good results have been reported by Bailley, Tauffer (intolerable molimina), Welponer (epilepsy cured, but case observed only 5 months after the operation), Kleinwächter (molimina, hæmatemesis; only observed for a short time). In Brugisser's case the symptoms returned at the end of a year.

Appendix.—Conditions of the sexual canal which prevent the excretion of the menses.

Only one operation in this category has been reported (*Kleinwächter, Ztschr. f. Heilk. Prag.* Bd. 30, 1884); it terminated fatally. Hæmatometra in acquired atresia of the cervix uteri. Extensive old pelvic peritonitis, no hæmatosalpinx.

IV. FIBRO-MYOMATA OF THE UTERUS.

Hegar: Mortality and Morbidity.

55 *Operations:*

6 deaths=11 per cent, 5 sepsis, 1 small contracted kidney.[1]

16 complications=29 per cent.

3 peritonitis, mild grade; 7 exudations and abscesses; 4 thromboses of the thigh; 1 pneumonia; 1 cystitis.

33 undisturbed course=70 per cent.

Among the 55 operations are 9 cases of coincident extirpation of large subserous myomata. All the patients recovered. In 7 complete recovery was noted for a long time; 2 cases occurred recently. Inasmuch as among the remaining operations, 6 terminated fatally, 12 are in part recent, in part no notes have been obtained recently concerning them, there remain 28 simple castrations, concerning which we are fully informed. Since at least 1½ years has elapsed since the operation (the first dates back to the year 1876) this table, although it does not embrace very many cases, has a special value.

28 *Operations:*

20 immediate cessation of all hemorrhages.

4 irregular hemorrhages at first, then cessation.

1 irregular hemorrhage continued.

1 at first menopause, then irregular hemorrhages.

1 at first menopause, then hemorrhage and fibro-cystic degeneration of the tumor.

1 at first menopause, then hemorrhage. Beginning enucleation. Removal of the tumor by Fehling.

28 *Operations:*

- 22 decided, usually very considerable, diminution in the size of the tumor.

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[1] One of these septic affections was not the result of the operation. The patient was undoubtedly infected by a student, who examined her several days before the operation. This was only discovered during the operation. The previously firm tumor was as soft as porridge; it had undergone gangrene.

2 not diminished.
1 doubtful, perhaps somewhat smaller.
1 unchanged.
1 formation of a fibro-cystic tumor.
1 enucleation.

Menopause and diminution in the size of the tumor are not always associated. The hemorrhages may cease although the tumor does not grow smaller. On the other hand the tumor may diminish, although the hemorrhages continue. But such cases are exceptional. We have always found very marked atrophy of the tumor associated with complete amenorrhœa.

Two patients grew stout to an annoying degree. In one of them bilateral purulent peritonitis and parametritis, which undoubtedly started from the pedicle, developed five years after the operation, which had been followed rapidly by the menopause and atrophy of the tumor.

It is an interesting fact that one patient was relieved of an extremely annoying irritative cough.

Tissier's large statistics give the following results:

171 operations, 25 fatal cases=14 per cent.

Causes of Death:

25 cases.
  12 sepsis.
  1 embolism of the pulmonary artery.
  1 pyelonephritis
  1 heart failure (11 days after the operation.)
  9 cause of death not noted.

Results as regards *hemorrhages:*

146 cases.
  89 cessation of all hemorrhages.
  21 menopause after longer or shorter duration of irregular hemorrhages.
  10 return of menses after cessation. In one of these cases an ovary had been left behind, in another an ovary was ligatured. In 3 cases the hemorrhages are noted as very moderate.
  26 hemorrhages not mentioned, but recovery noted.

Wiedow's statistics give the following results:

149 operations with 15 fatal cases=10 per cent.

Causes of Death:

15 cases.
- 11 sepsis.
- 1 paralysis of the heart.
- 1 bronchitis and nephritis.
- 2 not mentioned.

Results as regards *hemorrhages* and *atrophy* of the tumor.

76 cases.
- 54 atrophy and menopause in very short time.
- 7 menopause, but no statements concerning the tumor.
- 2 atrophy noted, but nothing concerning hemorrhages.
- 6 atrophy, but irregular, slight hemorrhages.
- 1 menopause for 3 months, then hemorrhage; enucleation of the myoma.
- 1 menopause, later periodical hemorrhages while the tumor atrophied.
- 1 slight hemorrhage after interval of 3 months, no statement concerning tumor.
- 3 diminution of tumor (for 2 years) with menopause, then return of growth and hemorrhage, once fibro-cystic degeneration, once irregular, considerable hemorrhage.
- 1 tumor not diminished.

Special importance attaches to Wiedow's table of 56 operations, whose results were ascertained at the end of at least a year.

56 cases:
- 39 menopause and atrophy of the tumor.
- 5 menopause, tumor not mentioned.
- 5 irregular, slight hemorrhages, atrophy.
- 1 menopause 3 months, then spontaneous enucleation began and was completed by artificial means.
- 1 menopause, then periodical hemorrhages, with diminution of the tumor.
- 1 feeble hemorrhage for twenty-four hours, at intervals of 3 months; tumor not mentioned.

3 menopause and atrophy of tumor for 2 years, then renewed growth and hemorrhage; fibro-cystic degeneration in one case.

1 irregular considerable hemorrhage; tumors not diminished.

Tait operated on 99 cases of myoma, with 9 fatal results, *i.e.*, about 7 per cent. No detailed statements are made concerning hemorrhages and the size of the tumor.

V. HYPERTROPHIES, VERSIONS AND FLEXIONS OF THE UTERUS.

Hegar: 25 *Operations.*

- 3 fatal cases=12 per cent.
- 1 complication, cystitis.
- 21 undisturbed course.

Hemorrhages. No notes concerning 6 cases or they are too recent.

- 16 cases.
  - 7 menopause.
  - 2 at first hemorrhages, later menopause.
  - 6 at first menopause, later hemorrhages.
  - 1 persistence of hemorrhage from the start.

Final Results:

- 16 cases.
  - 13 complete or almost complete recovery.
  - 1 unimproved.
  - 2 occasional pains, molimina, fluor.
  - 6 no notes or too recent.

In this category the morbid condition is almost always complicated, and we think it advisable, in the future, to place pure uterine hypertrophies (which must be very marked, if the question of castration is considered) in the same category with fibromata.

We can then differentiate pure relaxation-displacements with and those without prolapse and changes in the ovaries. Uterine displacements and changes of shape, following inflammatory processes of the peritoneum and cellular tissue, belong in the following category.

VI. PELVIC PERITONITIS, PARAMETRITIS, SMALL TUMORS OWING TO TUBAL DROPSY AND TUBO-OVARIAN CYSTS.

Hegar: 22 Operations:

- 3 fatal cases—13 per cent.
- 5 complications—22.7 per cent.; 3 exudation; 1 ileus, cured by laparotomy; 1 thrombosis.
- 14 undisturbed course—64.3 per cent.

Hemorrhages:

- 13 cases.
  - 10 menopause.
    - 1 hemorrhages, later menopause.
    - 2 menopause, later hemorrhages.
- 6 no notes or too recent.

Final Results:

- 14 cases.
  - 8 complete recovery.
  - 6 molimina, pains, nervous symptoms, persistent, though sometimes ameliorated.
- 5 no notes or too recent.

The results of other operators are also very unequal; while brilliant recoveries, even of severe neuroses, which had lasted for years, and psychoses, have been observed, in others no results were obtained.

On the whole castration is not a very dangerous operation. We are warranted in expecting that the results, as regards life, will become still better with increased perfection of technique and antisepsis, and especially with the proper understanding of the contra-indications and the more careful selection of cases.

So far as regards recovery the results are very favorable in small tumors, myomata, and other simple uterine diseases and anomalies of shape and position without complication. The third category, that of abnormalities and morbid conditions of the uterus, which prevent the secretion and excretion of the menses, contains too few cases to permit a positive opinion. The prognosis as regards recovery is not very favorable in inflammatory conditions of the ligaments, pelvic peritoneum and cellular tissue.

After unsuccessful operations it is generally found that irregular or periodical hemorrhages continue or reappear after the menopause has lasted a certain length of time. In some cases the other symptoms do not cease at all; or they are often relieved but reappear with the occurrence of hemorrhages; so that there can be no doubt of the connection. Exceptional cases are met with, in which the hemorrhages continue but the symptoms disappear.

The failures are the results of numerous causes. A fruitful source is the formulation of an improper indication. This includes castrations which are performed without any anatomo-pathological basis, on account of functional disturbances of the sexual system, neuroses and psychoses. We are also apt to make the mistake of falsely assuming a causal connection between an affection of the sexual system and the existing symptoms. Finally, such a connection may really exist, but the factor which gives rise to the symptoms is not reached by the operation. For example, it is supposed that the deeply situated ovary, which is in a condition of follicular cystic degeneration, gives rise to the symptoms, while the latter are really produced by a shrunken ligament.

The symptoms, especially those of a nervous character, were produced at first by a genital disease, but they have become so ingrained that the removal of the primary cause is ineffectual.

It is particularly in the production of nervous symptoms that, in addition to the genital disease, many other factors play a part. Sufficient consideration of the latter would entirely relieve the symptoms, but this is often overlooked. In addition, after-treatment is not carried out, as it is supposed that the operation will suffice.

Incompleteness of the operation is sometimes mentioned as a cause of the bad results. The ovary was not removed *in toto*, a portion being left in the stump or even outside of the latter, or a diseased tube was not extirpated.

Pronounced flaccidity of the abdominal walls, eventration, small abdominal herniæ, which result from the operation or are considerably intensified thereby, not infrequently exert an extremely injurious influence by producing changes in the pelvic circulation, displacement of individual organs. meteorism, nervous irritation (owing to traction and stretching).

Perhaps the most frequent cause of failure is the development of circumscribed inflammations of the pelvic peritoneum and cellular tissue.

Finally climacteric symptoms must also be mentioned. Even during the natural menopause we notice various nervous symptoms, especially of a vaso-motor character, and even in previously healthy women. No wonder that such symptoms are more prominent during the artificial menopause in women who have been ailing and whose nervous system usually is markedly affected. This sometimes appears to destroy the entire effect of the operation, inasmuch as the former symptoms are again produced. Fortunately the prognosis is not bad under such circumstances. Though a long time, even many months, may elapse, complete recovery finally ensues, if the symptoms are not the result of some other factor.

UNILATERAL CASTRATION.

As a matter of course this operation is indicated in those cases alone in which recovery is not to be produced by the artificial menopause, but by the removal of a focus of irritation. We must be convinced that the symptoms start from one ovary, or if this is not altogether true, that the extirpation of the organ will also relieve the other morbid factor. Unilateral castration will be performed most frequently in small tumors, adenocystoma, fibroma, dermoid cysts. In papillomata and malignant tumors both ovaries are almost always diseased and should be removed, merely for the sake of precaution.

In degeneration of the follicles and stroma, the disease is almost always bilateral. Moreover, the etiological factors are usually of such a nature that they act upon both organs. On the other hand the changes are not infrequently much more pronounced on one side, and the pains and other symptoms are often found to start chiefly or exclusively from one side. Under such circumstances, therefore, one ovary may be spared, if the patient is desirous of children. Although the results of unilateral castration are not very favorable, nevertheless a few successes have been reported. We will be so much more apt to perform this operation, if the cause of the disease acts to a great degree or perhaps exclusively upon one ovary. Thus, we sometimes find a considerably swollen ovary behind a retroverted uterus, while the other one is not impacted. Both ovaries may be affected in retroversion, one of them to a more marked extent. It is then hoped that unilateral castration and the correction of the displacement by stitching in the pedicle will suffice, inasmuch as the injurious effect on the other ovary ceases with the restoration of the proper position of the uterus.

In inflammatory processes of the peritoneum, tubes, etc., we generally look for the curative effect to the premature menopause and the removal of the pathological centre of irritation. In a few cases the process is confined quite sharply to one side. Upon this side are found tubal dropsy, the tubo-ovarian cysts, or pyosalpinx, while only moderate inflammatory changes are found on the other side. In such cases, also, we may spare one ovary if the patient desires children.

NOTES.

Unilateral extirpation of small tumors has often been performed. We mention the following:

Spencer Wells, solid adenoid tumor, laparotomy with fatal termination: ovarian fibroma, ascites and pregnancy (3 months), laparotomy, recovery.

Berry, cyst of left ovary, removed through a vaginal rupture resulting from artificial delivery, recovery.

Thomas, multilocular cystoma of right ovary, removed by vaginal incision, recovery after parametritis.

Gilmore, follicular cysts of left ovary, vaginal incision, recovery.

Battey, pedunculated dermoid cyst of left ovary, vaginal incision, recovery.

Stockes, follicular cyst in a prolapse of posterior vaginal wall, vaginal incision, recovery.

Girztowt, gangrenous dermoid cyst with small perforation through posterior vaginal wall, vaginal incision, recovery.

Thomas, small ovarian tumor, vaginal incision unsuccessful, laparotomy, death from peritonitis.

Wing, simple ovarian cyst, vaginal incision, recovery.

Prochownik, dermoid tumor, as large as an apple, on right side, laparotomy, recovery.

Schroeder, tumor of right ovary, as large as a duck's egg, retroflection of uterus; laparotomy, recovery; retroflection cured, pedicle stitched to abdominal wall.

Twelve other cases of unilateral extirpation have been reported. No death occurred, but three were followed by severe inflammation and one by slow convalescence. The results were not very good, in five no improvement and even aggravation of the symptoms. Good results in retroversion in two cases, in one of which the pedicle was fastened to the abdominal wall. In the other case this was not done, but the uterus remained in the normal position. Good result in one case of small cyst, degeneration of the ovary and salpingitis, and in one case of degenerated and prolapsed ovary with retroversion of the uterus. One good result in fibroma; the other ovary was imbedded in adhesions and could not be removed;

two slight hemorrhages occurred after the operation; short period of observation. Improvement noted in two cases. Péan extirpated the left indurated ovary, which was firmly adherent to the wall of the pelvis. Although the pains appeared to start chiefly from this ovary, they reappeared on the right side soon after the operation. Recovery did not ensue until the other ovary was removed. Fritsch's unilateral operation (retroversion, prolapse and small cyst degeneration of the ovary) was unsuccessful. Recovery occurred later, after extirpation of the other ovary.

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